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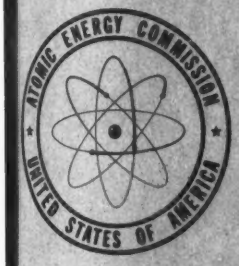

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NUCLEAR SCIENCE ABSTRACTS

Volume 10 September 15, 1956 No. 17

GENERAL

ATOMIC POWER

6455
ECONOMIC FUTURE OF FISSION PRODUCTS FOR RADIATION POWER. B. Manowitz and D. M. Richman (Brookhave National Lab., Upton, N. Y.). Nucleonics 14, No. 6, 98-102(1956) June.

An evaluation of the possibilities of obtaining income from fission products from the business of reprocessing spent reactor-fuel element is given. (F.S.)

RESEARCH PROGRAMS

6456 AECL-302
Atomic Energy of Canada Ltd. [Chalk River Project], Chalk River, Ont.
THE ATOMIC ENERGY PROGRAMME IN CANADA. W. J. Bennett. Feb. 22, 1956. 10p.

The broad objectives of the Canadian atomic energy program include the development of the economic use of atomic energy as a source of electric energy, and the production of radioactive isotopes for use in medicine, industry, and research. The present status of the program is reviewed. (C.H.)

6457 NP-6006
European Organization for Nuclear Research, Geneva.
FIRST ANNUAL REPORT OF THE EUROPEAN ORGANIZATION FOR NUCLEAR RESEARCH. 1955. 67p.

The history, organization, and research programs of CERN are briefly reviewed. A general discussion of the design and construction of the proton synchrotron and synchrocyclotron are given. A financial statement and a reports bibliography are appended. (D.E.B.)

BIOLOGY AND MEDICINE

6458 AEC-tr-2493
HEMAGGLUTINATION AND HEMOLYSIS IN MACACUS CYNOMOLGUS AND SIMIA RHESUS. Werner Fischer and Gertraudis Klinkhart. Translated from Z. Immunitätsforsch. 75, 513-25(1932). 22p.

6459
TUMOR INCIDENCE IN NORMAL SPRAGUE-DAWLEY FEMALE RATS. R. K. Davis, G. T. Stevenson, and K. S. Busch (Mound Lab., Miamisburg, Ohio). Cancer Research 16, 194-7(1956) Mar.

A tumor incidence of 57% was observed in 150 female rats allowed to live out their life-span as normal, control animals on standard laboratory chow. One hundred similar rats on a special fat-rich diet developed an 80% tumor incidence. Ninety-five per cent of the tumors observed involved mammary gland tissue. Twelve per cent of all tumors observed were of a malignant type. Eighty-seven per cent of all tumors appeared after the rats were 540 days of age, and the mean life-span after a tumor was first observed was 140 days. Related studies with a smaller number of animals indicated that male rats of the same strain were 5 times less susceptible to tumor formation than females. However, three of the four tumors that were examined histologically in the males were classified as malignant. The mean life span of normal female Sprague-Dawley rats in this laboratory was 760 ± 21 days, with individuals ranging in life span from 193 to 1100 days. (auth)

Refer also to abstract 6749.

RADIATION EFFECTS

6460 ANL-5576
Argonne National Lab., Lemont, Ill.
QUARTERLY REPORT OF BIOLOGICAL AND MEDICAL RESEARCH DIVISION. Apr. 1956. 102p. Contract W-31-109-eng-38. $0.50(OTS).

Progress is reported in the following studies: the effects of irradiation on immunity to parasite infections in mice; hemolysin production in irradiated rabbits; improved techniques for electron microscopy; a mathematical analysis of molecular transmutation data; an analysis of accepted values for hematopoietic activity; the methylation of homocysteine to methionine in bacteria; corrections for osmotic pressure changes in estimation of mitochondrial particle size; the effect of age, parity, and litter size on the acute lethal response of four inbred mouse strains to whole-body x irradiation; cytological studies of irradiation damage in mice; the effects of high-level single and repeated γ-ray dosages on the survival of mice; the effect of ionizing radiation on the fertility of mice; an analysis of the radiation response in the chick to dose and exposure time; the effect of single irradiation with fission neutrons on fertility in the female mouse; the effect of cysteine on irradiated nucleoprotein viscosity; leukocyte levels in irradiated dogs; the effect of injections of nonirradiated, centrifuged protoplasm on supralethally irradiated amoebae; applications of γ-ray spectrometry to biological tracer studies using Cr^{51}, Mn^{54}, and Zn^{65} mixtures; the effect of heat and radiation upon the condensation of carrier-free, radioactive phosphoric acid; application of liquid scintillation methods to biological tracer studies using P^{32} and Ca^{45} mixtures; and the chemical properties of various chelating agents. (For preceding period see ANL-5518.) (C.H.)

6461 HW-41500
Hanford Atomic Products Operation, Richland, Wash.
BIOLOGY RESEARCH—ANNUAL REPORT [FOR] 1955. Biology Section. Feb. 16, 1956. 188p. Contract W-31-109-Eng-52. $1.00(OTS).

Progress is reported in the following studies: the effect of Ca and Sr in soil on the uptake of Sr^{90} by barley plants; the effects of carrier upon the tissue distribution of Ca^{45} and Sr^{89} in rats; the effects of flow, diffusion, adsorption, and chemical reaction on isotopic dilution; observations on chinook salmon spawning in the Columbia River system over a 9-yr period; the toxic effects of chronic exposure to chromates on trout; the chronic build-up of radioisotopes in rats drinking concentrated reactor effluent water; the radiobiological monitoring of reptiles, birds, and mammals exposed to fission products in the Hanford area; the patho-

logical effects of Pu and Ru^{106} particles following intratracheal injection in mice; the preparation of quantitative autoradiographs of Ru^{106} in lung tissue; the foliar sorption of I^{131} by plants; the uptake of Sr^{90} by barley from contaminated soil; a comparison of the uptake of fission product elements by barley plants under various laboratory and field conditions; the effectiveness of glutathione in maintaining uniform suspensions of Po^{210} in yeast culture media; the effects of glutathione on yeast growth and on the oxidation of ferrous ions by x radiation; the relative biological effectiveness of S^{35} β and Po^{210} α particles for haploid and diploid yeast; the percutaneous absorption and decontamination of Pu in rats; the gastrointestinal absorption of Pu by rats; the absorption and turnover of Ru^{106} in rats; gastrointestinal radiation damage from ingested Ru^{106} in rats; the gastrointestinal absorption, distribution, bone deposition, and retention of various forms of P^{32} by rats; the pathological effects of both low-level chronic and acute administration of I^{131} in sheep; design of a two-probe scintillation detector capable of measuring from 0.25 to 200 μc I^{131} in swine thyroids; statistical techniques applicable to blood cell counts; and a statistical analysis of results of blood chemistry studies. A list of papers presented at meetings and publications during the period are included. (For preceding period see HW-35917.) (C.H.)

6462 NP-6016

National Academy of Sciences.

THE BIOLOGICAL EFFECTS OF ATOMIC RADIATION: A REPORT TO THE PUBLIC. 1956. 42p.

A group of scientists was appointed to investigate the effects of high-energy radiation on living things. The study was divided into six parts, each assigned to a separate committee. The areas considered include genetics, pathology, agriculture and food supplies, meteorology, oceanography and fisheries, and disposal of radioactive wastes. The nature of radiation is discussed briefly. Preliminary findings and recommendations are summarized. A list of the membership of each committee is included. (See also NP-6017.) (C.H.)

6463 UCLA-370

California. Univ., Los Angeles. Atomic Energy Project and California. Univ., Los Angeles. School of Medicine.

LATE EFFECTS OF TOTAL BODY ROENTGEN IRRADIATION. II. THE INFLUENCE OF FRACTIONATED AND SINGLE RADIATION DOSES ON THE INCIDENCE OF TUMORS, NEPHROSCLEROSIS AND ADRENAL VACUOLATION IN WISTAR RATS DURING VARIOUS PERIODS OF POST-IRRADIATION SURVIVAL. Baldwin G. Lamson, Raymond A. Meek, and Leslie R. Bennett. June 29, 1956. 75p. Contract AT-04-1-GEN-12. $0.45(OTS).

Late sequelae following 250 to 1600 r total-body x irradiation delivered under conditions of 5% and 20% oxygen to young female Wistar rats were studied. The onset of tumors was accelerated by doses of 500 r and above. A fractionated radiation dose produced a greater tumor accelerating effect than a single radiation exposure at the 800 and 1000 r levels. Benign tumors of the ovary appeared in 5% of the irradiated rats but were not observed in controls. Incidence of nephrosclerosis is directly related to the size of the radiation dose following an inversely dose dependent latent period. Increased heart size in the irradiated rats with and without nephrosclerosis suggests the wide prevalence of hypertension as a late radiation effect in this specie. Hypoxia during irradiation failed to protect against either nephrosclerosis or tumor acceleration. (auth)

6464 UCRL-3376

California. Univ., Berkeley. Radiation Lab.

THE DISTRIBUTION AND ACUTE EFFECTS OF LARGE DOSES OF IODINE-131 IN THE RAT. R. W. E. Watts and Patricia W. Durbin. Apr. 13, 1956. 16p. Contract W-7405-eng-48. $0.20(OTS).

The investigation reported herein was undertaken in order to determine the tissues particularly exposed to radiation injury following the administration of a large dose of I^{131}. The isotope distribution in the tissues of rats injected intravenously with 30 μc I^{131} per gram body weight was compared with that found after a dose of 0.33 μc per gram body weight, at 7-, 14-, and 21-day intervals postinjection. The body-weight changes and the results of hematological investigations, as well as histological studies of a wide range of tissues from animals receiving these doses of I^{131}, are also recorded. Apart from the thyroid gland, most of the retained isotope was in the carcass (consisting mainly of muscle, bone, and interstitial tissue) and in the pelt. Except for the pelt, the concentrations of I^{131} in most of the extrathyroid tissues were similar to one another. Only the thyroid gland, the lymphoid organs, and the myelopoietic elements of the bone marrow showed evidence of radiation damage after the larger dose of I^{131}. It is concluded that animals exposed to heavy internal irradiation with I^{131} suffer primarily from the effects of whole-body irradiation rather than from the results of specific extrathyroidal localization of I^{131}. (auth)

6465 UCRL-3398

California. Univ., Berkeley. Radiation Lab.

LONG-TERM SEQUELAE OF MASSIVE DOSES OF IODINE-131. I. HISTOPATHOLOGICAL FINDINGS. C. Willet Asling, Muriel E. Johnston, Patricia W. Durbin, and Joseph G. Hamilton. Apr. 27, 1956. 16p. Contract W-7405-eng-48. $0.20(OTS).

Histopathological studies have been made of a number of tissues from rats that had survived various doses (ranging from 10 to 90 μc per gram of body weight) of radioiodine. Findings described for each tissue at each dose level include such evidence as staining reaction, degeneration and regeneration, and development of abnormal cells. (auth)

6466 UR-438

Rochester, N. Y. Univ. Atomic Energy Project.

A COMPARISON OF THE EFFECTS OF RADIANT THERMAL ENERGY ON BARE, BLACKENED AND WHITENED PIG SKIN. H. W. Bales, J. R. Hinshaw, and H. E. Pearse. May 24, 1956. 33p. Contract W-7401-eng-49. $6.30(ph OTS); $3.00(mf OTS)

To study the properties required of a flash cream for protection against radiant thermal burns the surface of pigs' skin was altered by applying a black and white paint. Burns inflicted under these paints by a carbon arc source were compared with each other and with bare skin burns on the basis of surface appearance and microscopic measurement of damage. Expressions were obtained for the median effective exposures, in cal/cm^2, required to produce various surface grades and depths of damage for all three skin conditions. The data indicate that the radiant exposure for equivalent burns was the same for both whitened and bare skin at 0.3 sec, but as exposure time increased, relatively more energy was required for the whitened skin. On the other hand, the radiant exposure required to produce equivalent burns under the black paint at the shortest exposure time was only one-third of that for a similar burn on bare skin; as exposure time increased, this difference was less marked. (auth)

6467 UR-444

Rochester, N. Y. Univ. Atomic Energy Project.

LATE HEMATOLOGICAL EFFECTS OF EXPOSURE TO IONIZING RADIATION. M. Ingram. May 22, 1956. 24p. Contract W-7401-eng-49. $4.80(ph OTS); $2.70(mf OTS).

The literature relative to late effects of irradiation on

the blood of man and experimental mammals is summarized in tabular form. Certain relationships between exposure and effect become apparent when the data are reviewed in this manner, and the significance of these relationships is discussed briefly, with particular attention to differences between effects observed in peripheral blood leukocyte pictures of radiation workers during the early years of clinical radiology and the changes observed in more recent radiation workers. It is recommended that the compilation of data representing sensitive hematological indices of radiation exposure in large groups of radiation workers should be vigorously encouraged in hopes that eventually there may be enough long-term follow-up studies of the health of the workers to determine whether or not the changes are truly premonitory of latent radiation effects. (auth)

6468 UR-451

Rochester, N. Y. Univ. Atomic Energy Project.
THE IRRADIANCE DEPENDENCY OF EXPOSURE TIME AS A FACTOR IN DETERMINING THE SEVERITY OF RADIANT THERMAL BURNS. J. R. Hinshaw. May 17, 1956. 10p. Contract W-7401-eng-49.

The effects of six exposure times (0.5, 1.0, 3.0, 5.0, 10.0 and 30.0 sec.) in the production of burns on bare porcine skin by radiant exposures of 5 cal/cm^2 and 16 cal/cm^2 were investigated. The 5 cal/cm^2 exposure is most injurious at the shortest exposure time, and damage from it decreases as exposure time increases. On the other hand, 16 cal/cm^2 exposures are more destructive with 5.0 and 10.0 sec exposure times than with longer or shorter times. The importance of this change in time-intensity relationships in predicting injury on the basis of exposure and exposure time is pointed out. (auth)

6469 USNRDL-TR-84

Naval Radiological Defense Lab., San Francisco.
PHYSICAL PROPERTIES AND BIOLOGICAL EFFECTIVENESS FOR BURN PRODUCTION FLAME SOURCES. E. L. Alpen, C. P. Butler, S. B. Martin, and A. K. Davis. Dec. 21, 1955. 41p. [Project] NM 006-015.02. (AFSWP-778).

Measurements of the physical characteristics of flame sources of radiant energy were made, using radiometric equipment designed for use at nuclear weapon field tests. Biological studies of the effectiveness of this radiation in producing cutaneous burns in man and the rat showed that the radiation from this source has an effectiveness approximating the ideal maximum. Data on rat and human skin are compared. For human skin the persistent erythema critical energy was found to rise smoothly from 1.64 cal/cm^2 for a 1200°K source to 4.6 cal/cm^2 for a 6000°K source with no intermediate maxima in this temperature range. A general method was formulated for estimating critical energies for any spectral distribution of energy. (C.H.)

6470 USNRDL-TR-86

Naval Radiological Defense Lab., San Francisco, Calif. and Naval Medical Research Inst., Bethesda, Md.
INTERNAL RADIOACTIVE CONTAMINATION OF HUMAN BEINGS ACCIDENTALLY EXPOSED TO RADIOACTIVE FALLOUT MATERIAL. S. H. Cohn, R. W. Rinehart, J. S. Robertson, J. K. Gong, W. L. Milne, W. H. Chapman, and V. P. Bond. May 9, 1956. 50p. Project NM-006-015.

The first instance of exposure of human beings to significant internal contamination with fission products occurred as a result of the ingestion and inhalation of fallout material from a nuclear detonation in the Spring of 1954. An evaluation of the nature and extent of this internal radioactive contamination was made by a comparison of the radioelements excreted by the exposed human beings with data obtained from radiochemical analysis of the tissues and excreta of animals contaminated in the same event. The body burden of the group of human beings with the greatest internal contamination was near but did not exceed the maximum permissible levels for the individual radionuclides. Radioiodine and radiostrontium were present in highest concentrations at early times after exposure and were potentially the greatest internal hazard. The contribution of the internal radiation to the acute radiation syndrome observed appears to be small on the basis of the estimated body burden of the principal radioelements. In view of the short half-life of the most abundant fission products in this situation, the possibility that chronic irradiation effects will occur is quite small. (auth)

6471

EFFECTS OF ANOREXIA AND X-IRRADIATION ON VITAMIN B_6 EXCRETION IN RATS. Chung Suk Song, William N. Pearson, and William J. Darby (Vanderbilt Univ. School of Medicine, Nashville, Tenn.). Am. J. Physiol. 184, 309-11(1956) Feb.

6472

EFFECT OF HIGH-INTENSITY X-RADIATION ON THE A GROUP FIBERS OF THE FROG'S SCIATIC NERVE. Herbert B. Gerstner (U.S.A.F. School of Aviation Medicine, Randolph AFB, Tex.). Am. J. Physiol. 184, 333-7(1956) Feb.

6473

EFFECTS OF A SINGLE SESSION OF WHOLE BODY IRRADIATION IN THE RHESUS MONKEY. Mary V. Haigh and Edith Paterson (Christie Hospital and Holt Radium Inst., Manchester, England). Brit. J. Radiol. 29, 148-57(1956) Mar.

In the Rhesus monkey, the effects have been studied of different dose levels of x irradiation given at a single session. The data have yielded an LD_{50}(30 days) of 570 ± 25 r and a time of death of 14·7 ± 2·2 days for those animals dying after irradiation in the LD_{50} zone of doses. The symptomatology of the radiation syndrome in the monkey is described and is seen to conform to that of other mammals, differing only in the degree of prominence of certain symptoms. Late morbidity has been seen in two female but not in two male animals which survived doses higher than LD_{50}. In both, late loss of cellularity in the haemopoietic system was found, associated with monocytosis. Certain of the effects on the peripheral blood are not entirely due to radiation but to the experimental procedure. True radiation effects dependent on dose are seen to be related in the degree of depression of certain cells, in the duration of depression and in the hyperplasia which occurs during the recovery period. The prognostic value of symptoms and blood counts is discussed; only the behaviour of the reticulocytes was to give an indication of the survival of an individual, a good prognosis being indicated by a rise of reticulocytes during the second week. (auth)

6474

LIVER DAMAGE AND HEPATOMAS IN MICE PRODUCED BY RADIOACTIVE COLLOIDAL GOLD. A. C. Upton, J. Furth, and W. T. Burnett, Jr. (Oak Ridge National Lab., Tenn.). Cancer Research 16, 211-15(1956) Mar.

Colloidal radioactive Au^{198} was injected intravenously into mice in large doses in an attempt to produce neoplasms of the reticuloendothelial cells. The Au^{198} became rapidly concentrated in these cells, over 80% being retained in the liver. Of eight mice receiving 475 to 1350 μc, seven died within 2 weeks with leukopenia, necrosis of the bone marrow, and hepatic degeneration, and one mouse surviving 9 months died with cirrhosis. A dose of 44 to 160 μc of Au^{198}, estimated to deliver 850 to 3400 rep to the liver, caused no early deaths but produced chronic liver damage in 45 to 83% and

hepatomas in 10 to 26% of mice injected. In five of 31 livers examined microscopically, foci of ossification with marrow formation were noted. The incidence of leukemia was not significantly altered, and neoplasms of reticuloendothelial cells were not produced by the colloidal Au^{198}. An increase in the incidence of pulmonary adenomas occurred in mice receiving both radioactive and nonradioactive colloidal gold. (auth)

6475

POTENTIAL RADIOSENSITIZERS: SOME QUINONES AND RELATED COMPOUNDS. K. J. M. Andrews, D. H. Marrian, and D. R. Maxwell. J. Chem. Soc., 1844-54(1956) June.

Since some quinol bis(disodium phosphates) sensitize growing tissue towards the effects of ionizing radiation, three labeled compounds of this type were prepared for metabolic studies. The syntheses of some related compounds containing I_2 are also included. Bromination of the Diels–Alder adduct of toluquinone and butadiene leads to either a tri- or a tetra-bromo-derivative depending on conditions. The structure of each of these compounds has been determined. (auth)

6476

SENSITIVITY OF THE MOUSE TESTIS TO THE MUTAGENIC ACTION OF X-RAYS. C. Auerbach and B. M. Slizynski (Inst. of Animal Genetics, Edinburgh). Nature 177, 376-7 (1956) Feb. 25.

6477

THE BEHAVIOR IN TRANSPLANT OF LYMPHOCYTIC NEOPLASMS ARISING FROM PARENTAL THYMIC GRAFTS IN IRRADIATED, THYMECTOMIZED HYBRID MICE. L. W. Law and Michael Potter (National Cancer Inst., Bethesda, Md.). Proc. Natl. Acad. Sci. U. S. 42, 160-7(1956) Mar.

6478

INACTIVATION OF SOME ANIMAL VIRUSES WITH GAMMA RADIATION FROM COBALT-60. Russell T. Jordan and Lloyd L. Kempe (Univ. of Michigan, Ann Arbor and City of Hope Medical Center, Duarte, Calif.). Proc. Soc. Exptl. Biol. Med. 91, 212-15(1956) Feb.

Gamma radiation from Co^{60} proves to be an effective method for inactivation of Lansing poliomyelitis, St. Louis encephalitis, Western equine encephalomyelitis and vaccinia viruses. Partially purified suspensions of viruses tested were more vulnerable to lethal effects of γ radiation than were crude suspensions. In crude and partially purified suspensions the smaller viruses required larger doses of γ radiation for inactivation than did the larger viruses. The rate of inactivation for viruses tested, within error of experiment, is an exponential function of the dosage of gamma radiation. (auth)

6479

THE EFFECTS OF IRRADIATION ON THE ABSORPTION AND DISTRIBUTION OF DIOEYLPALMITIN-C^{14} IN THE RAT. Margaret G. Morehouse and Ronald L. Searcy (Univ. of Southern California School of Medicine, Los Angeles). Radiation Research 4, 175-85(1956) Mar.

6480

THE PROMPT EFFECTS OF WHOLE-BODY IRRADIATION AT A HIGH DOSE RATE ON THE ELECTROENCEPHALOGRAM OF MONKEYS. Phillips M. Brooks (U. S. A. F. School of Aviation Medicine, Randolph AFB, Tex.). Radiation Research 4, 206-16(1956) Mar.

6481

INTERPRETATION OF SOME ENZYME ACTIVITY INCREASES AFTER WHOLE-BODY X-IRRADIATION. Robert N. Feinstein (Argonne National Lab., Lemont, Ill.). Radiation Research 4, 217-20(1956) Mar.

Phosphoprotein phosphatase, the enzyme which hydrolyzes inorganic phosphorus from phosphoproteins without preceding proteolysis, appears to be increased in activity in the spleen and intestine after whole-body x irradiation, if the calculations are based on wet weight or protein content. It is pointed out that these data, like numerous other examples cited in the literature, are actually only mathematical artifacts due, in the case of spleen, to loss of organ weight and, in the case of intestine, to loss of protein. (auth)

6482

THE RELATIVE BIOLOGICAL EFFECTIVENESS OF TRITIUM β-RADIATION WITH THE BROAD BEAN ROOT (VICIA FABA) AS A TEST SYSTEM. J. F. Spalding, Wright Langham, and Ernest C. Anderson (Los Alamos Scientific Lab., N. Mex.). Radiation Research 4, 221-7(1956) Mar.

6483

COMPARATIVE EFFECTIVENESS OF SEVERAL X-RAY QUALITIES FOR ACUTE LETHALITY IN MICE AND RABBITS. Douglas Grahn, George A. Sacher, and Howard Walton, Jr. (Argonne National Lab., Lemont, Ill.). Radiation Research 4, 228-42(1956) Mar.

The comparative acute lethal effect for mice and rabbits of x rays in the range of 80 to 250 kvp has been studied. Increases in the LD_{50} doses occur in both species with decreasing x ray energy. Based on dosimetry in homogenous phantoms, the LD_{50} values expressed as mean body doses continue to increase instead of holding constant, indicating that the dose-reduction principle does not hold. Two alternative statistical hypotheses have been considered: a constant-slop hypothesis and a combination of the dose-reduction and constant-slope hypothesis. Qualitative consistency of the data with the results of experimental partial-body shielding is indicated. The concept of the subtractive dose is confirmed in part by data from partial-body irradiation wherein more favorable hematopoietic recovery acts to enhance survival. Since dosage declines significantly with depth at the lower energies, a degree of inmate partial-body shielding must exist even after whole-body exposure, thereby favoring survival through a reduction of the dose to tissues of the hematopoietic system, particularly the bone marrow. According to available evidence, the latter would be additionally shielded due to the high absorption of low-energy x rays by bone. (auth)

6484

BIOLOGICAL EFFECTS OF FAST ELECTRONS AND ULTRA-HARD X RADIATION FROM A 15-MEV BETATRON COMPARED WITH X RADIATION OF USUAL HARDNESS. H. Gärtner. Strahlentherapie 96, 378-95(1955) Mar. (In German)

The experimental results found after irradiation of tissue cultures with high-speed electrons and ultra-hard roentgen rays are compared to those obtained after roentgen irradiation (184 kv) of equal dose and equal dose output. The quantitative and qualitative differences with respect to the effect produced by these irradiations as well as the clinical applicability of energetic radiations are discussed. (auth)

6485

REPORT ON FURTHER RESEARCH OF THE BIOLOGICAL EFFECTS OF ULTRAFRACTIONATED IRRADIATIONS. D. Hofmann and K. Müller. Strahlentherapie 96, 403-7 (1955) Mar. (In German)

By means of stroboscopic disks with a great number of revolutions, the authors made more extensive investigations regarding the dependence of the biological effect on the conditions of ultrafractionated irradiations (β-rays of radium). The eggs of Drosophila melanogaster, 1.5 and 4.5 hours old, were used in these experiments. The authors found complicated relations between frequency and effect which generally

had at least one pronounced maximum of action. Their formation seems to be attributable to reciprocal actions between the radiation impulse and the restitutional pause. (auth)

6486

RADIATION DAMAGE ON HUMAN BONES AFTER DEEP ROENTGEN THERAPY TO FEMALE CARCINOMA. Gerd Schröder. Strahlentherapie 96, 469-73(1955) Mar. (In German)

On the basis of animal experiments and clinical findings, the author calls attention to the possibility of the fully developed human bone being damaged by the influence of roentgen rays. He describes 4 cases of pathological fractures after intensive deep roentgen therapy of cancer of mamma with typical localization in the upper, anterior ribs. The dose focus was approximately 4000 r. The latent period up to the time when changes could be detected by roentgenological means, and when pains were felt by the patient, varied from 3 months to 2 years. Most of these radiolesions will neither become manifest nor reveal symptoms. (auth)

6487

BIOLOGICAL EFFECT OF IONIZING RAYS ON LATENT WHEAT GERMS. Rosina Zdansky. Strahlentherapie 99, 129-46(1956) Jan. (In German).

The germs of wheat grains x rayed with 100 r in dry condition show retardation or acceleration in certain phases of development. Whereas the retardation is not dependent on temperature, accelerations have been observed only in case of germination temperatures over 18°C. Observations have proved that the simultaneous or posterior application of sound waves to x-rayed grains causes additional damage and that the effect of x ray damage is influenced by different temperatures in different seasons. This fact urges the conclusion that the x ray damage is due to ray-induced fractures of the chromosome sections of the embryonic cells. (auth)

6488

THE INFLUENCE OF SERUM ALBUMEN FRACTIONS IN CANCER DURING FRACTIONAL ROENTGEN IRRADIATIONS. A. Verhagen and F. Meibner. Strahlentherapie 99, 162-5(1956) Jan. (In German).

Roentgen irradiations of patients suffering from gynecological carcinoma results in a shift of the serum albumin fractions, which is detectable in the electrophoresis diagram. Data are tabulated from a series of studies. (auth)

RADIATION HAZARDS AND PROTECTION

6489 AF-SAM-55-61

Chicago. Univ. Air Force Radiation Lab.

BIOLOGICAL AND MEDICAL ASPECTS OF IONIZING RADIATION. MODIFICATION OF THE RADIATION-INDUCED INCREASES IN PHOSPHATASE ACTIVITY OF HEMATOPOIETIC TISSUES BY CHEMICAL AGENTS. Donald F. Petersen and Kenneth P. DuBois. Sept. 1955. 8p.

The ability of x irradiation to induce reproducible, dose-dependent increases in the adenosine triphosphatase and 5-nucleotidase activities of the spleens and thymus glands of rats suggested the possibility of using phosphatase assays as a method of estimating the effectiveness of chemical agents in modifying radiation damage. Experiments with p-aminopropiophenone, cysteine, and mercaptoethylamine demonstrated that pretreatment with these agents alone or in combination reduced the amount of increase in phosphatase activity in the spleens and thymus glands of irradiated rats. The protective capacity of each compound against x-ray mortality coincided with its ability to diminish the phosphatase activity of hematopoietic tissues. It was, therefore, concluded that these protective agents modify radiation damage to the hematopoietic tissues. The results of this study indicated the potential usefulness of adenosine triphosphatase and 5-nucleotidase assays for evaluating the efficacy of chemical agents in protecting hematopoietic tissues from radiation damage. (auth)

6490 GPI-14

Atomic Energy of Canada, Ltd. Chalk River Project, Chalk River, Ont.

THE ACCIDENT TO THE N.R.X. REACTOR. PART II. D. G. Hurst. Oct. 23, 1953. 33p. (AECL-233).

Problems which faced the operating staff as a consequence of the NRX accident are discussed. These include containment of active water, cooling of broken rods, and assessment of damage. Information is given concerning the state of the fuel rod assemblies and calandria. It appears that the major damage followed boiling of cooling water. Explanations are presented of some of the observed phenonema, in particular a sudden rise of the gasholder, and some details of fuel rod behavior. (auth)

6491 HW-42946

Hanford Atomic Products Operation, Richland, Wash.

RADIOACTIVITY LEVELS OF THE COLUMBIA RIVER BELOW RICHLAND, WASHINGTON FOR THE PERIOD OCTOBER, NOVEMBER, DECEMBER 1955. Radiological Sciences Dept. R. E. Rostenbach. May 1, 1956. 9p. Contract W-31-109-Eng-52. $1.80(ph OTS); $1.80(mf OTS).

Below Richland, Washington there is a general decrease in the concentration of β particle emitters in the Columbia River water. The concentration of α particle emitters in Columbia River water averages less than 5×10^{-9} μc/ml at all locations. The activity of α particle emitters in mud samples was less than the detection limit of 3×10^{-6} μc/gm; the average activity density of β particle emitters approximates those reported for the previous quarter. (For preceding period see HW-42181.) (C.H.)

6492 NARF-56-4T

Convair, Fort Worth, Tex.

HEALTH PHYSICS ACTIVITIES DURING PERIOD IV, OCTOBER 1, 1954 TO SEPTEMBER 30, 1955. R. F. Shockley, comp. and ed. May 4, 1956. 85p. Project No. 6(1-9964). Contract AF33(600)-32054. (FZK-9-096).

The organization of the Health Physics Group is briefly described. Photographs of radiation detection instruments and equipment used by the group are included. Results of radiological environmental monitoring surveys are presented in tabular form. (C.H.)

6493 NYO-4682-A

New York Operations Office. Health and Safety Lab., AEC.

FALLOUT COUNTERMEASURES FOR AEC FACILITIES. Preliminary Report. Alfred J. Breslin and Leonard R. Solon. Dec. 1955. 66p.

Results are presented from a preliminary evaluation of possible measures which may be applied to afford protection to personnel and to render a facility inhabitable from the point of view of conducting normal functions following exposure to a potentially lethal fall-out event. Theoretical relationships were derived to demonstrate the feasibility of estimating the protection against γ radiation afforded by conventional structures. Methods are suggested by which the inherent protection may be increased. Criteria are suggested from which may be determined the time after a bomb detonation when recovery operations may be begun safely. It was concluded that practical countermeasures capable of providing adequate protection and enabling the prompt reactivation of plant functions are feasible. (C.H.)

6494 UR-452

Rochester, N. Y. Univ. Atomic Energy Project. FAILURE OF S, β-AMINOETHYLISOTHIURONIUM • Br • HBr TO PROTECT AGAINST LETHAL TOTAL BODY X-IRRADIATION IN DOGS. R. E. Benson, S. Michaelson, and J. W. Howland. June 5, 1956. 15p. Contract W-7401-eng-49. $3.30(ph OTS); $2.40(mf OTS).

The protective effect of a new compound, S,β-Aminoethylisothiuronium • Br • HBr (AET), against the lethal effects of 594 r of 1-Mev x radiation was tested in 21 dogs utilizing 14 additional dogs as controls. Data are presented which indicate failure of this compound to enchance survival or survival rate. (auth)

6495

ESTIMATING AIRBORNE RADIOACTIVE PARTICULATE HAZARDS—A REVIEW OF SAMPLING CRITERIA. T. J. Burnett (Oak Ridge National Lab., Tenn.) and T. F. Hatch (Univ. of Pittsburgh). Am. Ind. Hyg. Assoc. Quart. 17, 80-4(1956) Mar.

Methods for sampling airborne radioactivity in air are reviewed and evaluated. (C.H.)

6496

RADON DAUGHTERS IN MINE ATMOSPHERES—A FIELD METHOD FOR DETERMINING CONCENTRATIONS. Howard L. Kusnetz (Public Health Service, Salt Lake City, Utah). Am. Ind. Hyg. Assoc. Quart. 17, 85-8(1956) Mar.

A new concept of describing the tolerance level of radon daughters has been presented. This concept is in terms of the alpha-energy dose resulting from the complete decay of the daughters. A rapid field method for determining atmospheric concentrations of radon daughters in terms of Mev of alpha energy/liter has been shown. No attempt has been made to set a maximum allowable concentration for radon and/or its daughters. (auth)

6497

RADIOACTIVE STRONTIUM FALLOUT. W. F. Libby (U. S. Atomic Energy Commission, Washington, D. C.). Proc. Natl. Acad. Sci. U. S. 42, 365-90(1956) June.

Hazards from Sr^{90} deposited in fall-out following nuclear explosions are reviewed. Strontium^{90} is of particular interest among the fission products because of chemical similarity to Ca, an average life of about 40 years, and a low rate of skeletal elimination. The maximum permissible average concentration of Sr^{90} in the adult skeleton is calculated to be 1 μc/1,000 gm of Ca. Data are summarized on Ca, Sr, and Sr^{90} concentration in samples of soil, animal, and plant material collected throughout the world before and after the thermonuclear explosions during Operation Castle. A Sr^{90} fall-out probably derived from megaton weapons and nearly uniform over the world, except for local effects due to rainfall variations and to fall-out from submegation weapons, was found to occur at least 1.7 years after the megaton test series. The average world-wide Sr^{90} fall-out rate in the fall of 1954 and the spring and summer of 1955 was 1.2 mc/mi^2/yr. An estimate is presented of the fall-out rate of Sr^{90} to be expected from weapons tests up to and including the Castle series. Factors influencing the transfer of Sr^{90} from soil to plants, to animals and milk produced by them, and finally to the human skeleton are discussed. (C.H.)

6498

A STUDY OF THE EFFECTIVENESS OF PYRIDOXINE AND DRAMAMINE ON CLINICAL RADIATION SICKNESS. Anna Silverman, Morton M. Kligerman, John W. Fertig, and Kent Ellis. (Columbia Univ. Coll. of Physicians and Surgeons, New York and Presbyterian Hosp., New York). Radiology 66, 403-7(1956) Mar.

A statistically controlled clinical study of the effectiveness of Dramamine and pyridoxine on the course of radiation sickness is reported. The group, studied over a period of one year, included 185 patients receiving deep x ray therapy. No significant differences were found in the frequency or duration of symptoms attributable to radiation sickness in groups of patients receiving pyridoxine, Dramamine, or a placebo. (auth)

6499

THE LOCAL EFFECTIVENESS OF CYSTEINE IN RADIATION PROTECTION. D. Hofmann. Strahlentherapie 96, 396-402(1955) Mar. (In German)

The protective effect against radiolesions, produced by cysteine has hitherto mainly been proved in lower biological objects and by using as a criterion the survival rate of animals, exposed to total-body irradiations. The local protective effect which, so far, has merely been proved in one case, is confirmed by the author with respect to erythema of the rat tail. Subcutaneous injections of a watery solution of cysteine proved to be the most effective protection, while, to a certain extent, protection was equally obtained with cysteine ointment as well as with cystine ointment. The photoelectric method used for evaluating purposes, confirmed that an exclusively inspectional judgement of erythemas is often sufficient. (auth)

6500

THE EFFECT OF O_2 PRESSURE ON THE SENSITIVITY TO RADIATION BY TOTAL BODY EXPOSURE. H. St. Stender and Th. Hornykiewytsch. Strahlentherapie 96, 445-52(1955) Mar. (In German)

In normal and adrenalectomized rats as well as in rats pretreated with cortisone and thyrosine, the radiosensitivity decreases, if the oxygen tension in the breathing air is reduced below 10%. If the animals are pretreated with megaphen, then the protective effect produced by the reduced oxygen tension, is even considerably stronger. (auth)

6501

THE INFLUENCE OF MEGAPHEN ON THE SENSITIVITY TO RADIATION BY TOTAL BODY EXPOSURE. H. St. Stender and Th. Hornykiewytsch. Strahlentherapie 96, 453-7(1955) Mar. (In German)

A preliminary treatment of rats with Megaphen brings about an increase of the medium survival time after total-body irradiations with 800 and 1000 r, and of the survival rate after 600 r. A similar effect takes place in adrenalectomized rats after 600 r. Oxygen deficiency considerably increases the effect of Megaphen. An after-treatment with Megaphen merely exerts a minor influence on the survival time. The author discusses the mechanism of action of the protective effect brought about by Megaphen. (auth)

6502

INVESTIGATION ON A BIOLOGICAL PROTECTIVE SCREEN. II. RADIOSENSITIVITY EFFECTS OF CARBOHYDRATES. H. Langendorff, R. Koch, U. Hagen, and H. Scharnbeck. Strahlentherapie 99, 121-8(1956) Jan. (In German).

Diverse hexoses and pentoses have no influence on the sensibility towards x-rays of rats and mice. Pyruvate, oxy-butyrate, and keto-glutarate increase the resistance. An acid coma provoked by pyruvic acid or β-oxybutyric acid and the entailed hypoxia have no effect on the resistance. The influence of alloxan diabetes is not considerable. (auth)

6503

THE ABSORPTION COEFFICIENT OF THE β-ENERGY OF RADIOACTIVE ISOTOPES. II. FOUNDATION OF β-RADIATION DOSIMETRY. K. Sommermeyer and K.-H. Waechter. Z. angew. Phys. 8, 53-61(1956) Feb. (In German)

RADIATION SICKNESS

6504 NM-006-012.04.93

Naval Medical Research Inst., Bethesda, Md. and National Institutes of Health, Bethesda, Md.

EXPERIMENTAL THERAPY OF THE GASTROINTESTINAL SYNDROME PRODUCED BY LETHAL DOSES OF IONIZING RADIATION. R. A. Conard, E. P. Cronkite, George Brecher, and C. P. A. Strome. Dec. 6, 1955. 12p.

The gastrointestinal syndrome and its therapy were studied in dogs exposed to high supralethal doses of ionizing radiation. (auth)

RADIOGRAPHY

6505 AMRL-219

Army Medical Research Lab., Fort Knox, Ky.

THE APPLICATION OF FILM INTENSIFICATION TO RADIOISOTOPIC RADIOGRAPHY. Alvin Shemesh and Wayne E. Rice. Jan. 25, 1956. 18p.

A process of film image intensification, previously used in heightening contrast in normal radiography, was applied to radioisotopic radiography, particularly with $_{69}Tm^{170}$. Picture contrast was increased 4.5 times with chemical intensification using DuPont Iron-Toner-Intensifier, and as much as 12.5 times by optical intensification using colored filters to observe the results. This process may well serve to place renewed emphasis on isotopic radiography for medical use. Specific results with thulium radiography were very encouraging, increasing contrast in normally flat, under-exposed radiographs to produce acceptable pictures. (auth)

6506

LATE SKELETAL ROENTGENOGRAPHIC, HISTOPATHOLOGICAL, AUTORADIOGRAPHIC AND RADIOCHEMICAL FINDINGS FOLLOWING RADIUM DEPOSITION. W. B. Looney (Argonne National Lab., Lemont, Ill.). Am. J. Roentgenol. Radium Therapy Nuclear Med. 75, 559-72(1956) Mar.

It has been possible to demonstrate by authoradiographic studies the manner of deposition of radium in the skeleton; by histologic studies, the histopathologic changes that have taken place; and by roentgenographic studies, changes that have occurred as a result of the histopathologic changes. The material for this study was obtained at autopsy from a patient who died in 1951 from an osteogenic sarcoma of the foot (age forty-eight years). (auth)

Refer also to abstract 6838.

RADIOTHERAPY

6507

ROTATION THERAPY WITH A COBALT 60 UNIT. II. TRANSIT DOSE MEASUREMENTS AS A MEANS OF CORRECTING TUMOUR DOSE FOR NON-WATERQUIVALENT ABSORBING MEDIA. Paul M. Pfalzner. Acta Radiol. 45, 62-8(1956) Jan.

Transit dose measurements in rotation therapy with a Co unit are used to calculate effective water-equivalent chest contours. These are made the bases for arriving at a tumour dose in the thorax corrected for low absorption in lung tissue. Approximate analytical and practical justifications of the method are discussed. (auth)

6508

THE UPTAKE OF RADIOACTIVE PHOSPHORUS IN NORMAL BREAST AND BREAST TUMORS. N. N. Das Gupta, K. L. Bhattacharya, R. Dutt Choudhuri, A. Bose, and P. K. De. Acta Radiol. 45, 69-80(1956) Jan.

Radioactive phosphorus (P^{32}) was administered to 48 patients with breast tumors and the superficial beta activity over the tumor and over a corresponding site of normal breast measured. The relative activity in 85% of the histologically proved malignant tumors was found to range from 130 to 350% of the normal, while 82% of the benign tumors showed an uptake ratio ranging from 100 to 130% of the normal. In about 17% of the total number of cases, the probable diagnosis based on radioactivity measurement was at variance with the histologic report. It is suggested that the use of P^{32} in the diagnosis of malignancy can be a useful adjunct to the already existing pathologic test. (auth)

6509

A TRANSILLUMINATOR FOR USE WITH THE CURVED GEIGER COUNTER. AN AID TO LOCALIZATION OF POSTERIOR INTRAOCULAR NEOPLASMS. Charles I. Thomas and Jack S. Krohmer (Western Reserve Univ. School of Medicine and Univ. Hospitals, Cleveland). Arch. Ophthalmol. 55, 413-14(1956) Mar.

6510

RADIOACTIVE ISOTOPES AND NUCLEAR RADIATIONS IN THE TREATMENT OF CANCER. John H. Lawrence and Cornelius A. Tobias (Univ. of California, Berkeley). Cancer Research 16, 185-93(1956) Mar.

Results are reviewed from 20 years experience with radioactive isotopes and nuclear radiations in the treatment of cancer. 59 references. (C.H.)

6511

A REVIEW OF DEPTH THERAPY WITH RADIOISOTOPES. Rudolf Breig and Günter Ziegler. Strahlentherapie 99, 275-81(1956) Feb. (In German).

A consideration of the possibilities for a depth therapy by means of gamma irradiation of radioactive isotopes shows that, at the moment, radio-cobalt takes the first place for the teletherapy. The advantages of this therapy method over the usual depth irradiation are explained. (auth)

6512

SURVEY OF THE THERAPEUTICS OF RADIOACTIVE SUBSTANCES. Alexander Catsch. Strahlentherapie 99, 290-300(1956) Feb. (In German).

The author gives a survey on the behaviour of some potentially toxic radioisotopes in the organism and discusses the therapeutical possibilities resulting from these observations. The following substances have shown best therapeutical efficiency: colloidal zirconium salts, complex formers (nitrilo-triacetic acid, ethylenediamine tetraacetic acid) and soluble ion exchangers (condensed phosphates). The secretion of some especially dangerous radioisotopes in the organism is intensified. (auth)

Refer also to abstract 6888.

TOXICOLOGY STUDIES

6513

URINARY EXCRETION OF AMINO ACIDS BY MEN ABSORBING HEAVY METALS. T. W. Clarkson and J. E. Kench (Univ. of Manchester, England). Biochem. J. (London) 62, 361-72(1956) Mar.

The effects of absorption of Pb, Hg, U, and Cd on urinary excretion of amino acids have been investigated. Cd and U produced more profound changes than did Pb and Hg in the total urinary amino-nitrogen levels and in the amino acid patterns. The urinary concentrations of the hydroxyamino acids threonine and serine were particularly increased by absorption of U and Cd. A relative increase in alanine was found in five out of fifteen Pb-containing urines, and in glycine in three out of six Hg-containing urines. The observations are discussed in relation to the causation of the

amino aciduria and the possible role that heavy metals may play in the elucidation of the reabsorptive pathways in the renal tubular cells. (auth)

6514

ON THE ROLE OF RADIOTHORIUM (Th^{228}) IN RADIUM POISONING. M. A. Van Dilla and B. J. Stover (Univ. of Utah Coll. of Medicine, Salt Lake City). Radiology 66, 400-2(1956) Mar.

TRACER APPLICATIONS

6515 AERE-SPAR-7

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

FISSION PRODUCT UPTAKE IN PLANTS. PAPER 7. E. Glueckauf. July 1955. 4p.

It is concluded that specific enrichments of Sr and Cs by comparison with Ca or K respectively in large parts of the plant (apart from the root) can occur only in such parts which are not subject to much transpiration, and which therefore can approach an exchange equilibrium. On the other hand the largest accumulations of fission products taken up from the soil should arise in the parts with much transpiration, which also accumulate a much larger solids content in general. There are certain rules by which equilibrium exchange processes can be distinguished from kinetic influx of ions. These show that the root substrate takes up fission products by exchange, which may be accompanied by enrichment, while the root and plant fluid, and consequently the bulk of the plant, derive their ionic contents from non-equilibrium transport processes. (auth)

6516 UR-447

Rochester, N. Y. Univ. Atomic Energy Project.

AUTORADIOGRAPHIC STUDY OF EFFECTS OF ROUTE OF ADMINISTRATION ON DISTRIBUTION OF POLONIUM^{210}. Louis J. Casarett. Apr. 3, 1956. 21p. Contract W-7401-eng-49. $4.80(ph OTS); $2.70(mf OTS).

Tissues of rats and cats have been examined autoradiographically following oral or intravenous administration of Po^{210} in saline or citrate solution. Emphasis was placed on lung, liver, spleen and kidney. Aggregates of Po are found in tissues after intravenous injection but not after oral administration to either species. Aggregates are located in alveolar walls of lung, in Kupffer cells of the liver, and in the red pulp of the spleen. Decrease in the numbers and size of aggregates occurs with decreased concentration, slower rate of administration and addition of a complexing agent (citrate). Anatomical location of the aggregated Po is qualitatively unchanged by the above parameters. The significance of these autoradiographic findings is discussed, particularly with reference to distribution differences and toxicity. (auth)

6517

THE DEPOSITION OF ^{35}S IN CORTICAL BONE. P. W. Kent, J. Jowsey, L. M. Steddon, R. Oliver, and J. Vaughan (Univ. of Oxford, England and Churchill Hospital). Biochem. J. (London) 62, 470-6(1956) Mar.

CHEMISTRY

6518 CCC-1024-TR-177

Boston Univ.

THE HEATS OF SOLUTION OF BORON HYDRIDES AND DERIVATIVES IN LIQUID AMMONIA; THE HEAT OF AMMONIATION OF THE HYDROGEN BRIDGE STRUCTURE IN BORON HYDRIDES. J. R. Sinclair, L. V. Coulter, and A. G. Cole. Mar. 8, 1956. 12p. [For Callery Chemical Co. Contract NOa(s)-52-1024-c].

Heats of solution of diborane diammoniate, pentaborane(9), decaborane, and dimethylaminodiborane in liquid NH_3 were found to be, respectively, -10.5 ± 0.4; -40.6 ± 0.2; -36.1 ± 0.4; -20.4 ± 0.5 kcal/mol. From these values and the heats of formation of the boron hydrides in NH_3. In addition, the heat of solution of liquid B_2H_6 in NH_3 was calculated to be -29.2 kcal/mol. From the heats of mixing of the liquid boron hydrides with liquid NH_3 were derived the heats of solvation per bridge hydrogen, the values of which appear to be dependent on the nature of the particular bridge structure involved. The values obtained for the heats of solution and solvation of the boron compounds are interpreted in the light of the known structures of these compounds. (auth)

6519 CCC-1024-TR-191

Kansas. Univ., Lawrence.

VAPORIZATION AND X-RAY STUDIES OF BORON CARBIDE. P. W. Gilles and H. E. Robson. June 19, 1956. 25p. For Callery Chemical Co. Contract NOa(s)-52-1024-C.

Preliminary effusion vapor pressure measurements indicate that boron is preferentially vaporized from all boron carbide compositions. Relationships between crystal lattice parameters and composition in the solid-solution range have been tentatively established for use in analyzing boron carbide. Several thermodynamic functions of $B_4C(s)$ have been calculated and tabulated. (auth)

6520 CF-53-5-172

Oak Ridge National Lab., Tenn.

COST ESTIMATE CHECK LIST FOR A NEW PROJECT. W. G. Stockdale. May 25, 1953. 17p. Contract [W-7405-eng-26]. $3.30(ph OTS); $2.40(mf OTS).

In order to prepare adequate cost studies for new programs which are developed in the Chemical Technology Division an itemized list for capital and operating costs is presented to be used as a guide. The availability of cost indices, to relate the value used from listed cost to a current basis, is included. (F.S.)

6521 LA-2107UNM

New Mexico. Univ., Albuquerque.

THE EXCHANGE REACTION BETWEEN SUBSTITUTED BENZYL IODIDES AND POTASSIUM IODIDE. VI. p-BROMOBENZYL IODIDE. Milton Kahn and J. L. Riebsomer. Mar. 1956. 8p. For Los Alamos Scientific Lab. Subcontract under [W-7405-eng-36]. $0.15(OTS).

A measurable exchange has been observed in CH_3OH and C_2H_5OH between the iodine atom in p-bromobenzyl iodide and the I^- in KI. The exchange reaction was investigated over a temperature range from 0 to 30.9°. The total iodide concentration in CH_3OH and in C_2H_5OH ranged from 0.0113 to 0.00152M and 0.00999 to 0.00149M, respectively. The rate laws for the exchange reaction are $R = 1.80 \times 10^{12} \exp[-16{,}650/RT](p\text{-BrBzI})\,(KI)$ in CH_3OH, and $R = 4.13 \times 10^{12} \exp[-16{,}660/RT](p\text{-BrBzI})\,(KI)$ in C_2H_5OH, where the units of R are moles $\times$ liter^{-1} $\times$ min^{-1}. (auth)

6522 MCC-1023-TR-150

Ohio State Univ. Research Foundation, Columbus.

THE PURIFICATION OF DIBORANE. George E. MacWood and Leo L. Paridon. June 10, 1955. 9p. [For Olin Mathieson Chemical Corp. Contract NOa(s)-52-1023-c].

Diborane of 99.91 mole per cent purity can be prepared by a relatively simple procedure. Distilled diborane (98.6 mol. %) containing ethane as impurity is treated with pyridine, which forms a nonvolatile salt with B_2H_6. Treatment of the pyridine salt with BF_3 liberates B_2H_6 which is passed through dioxane to remove entrained BF_3. Final distillation through a glass packed column gives B_2H_6 of 99.9 mol. % purity. (auth)

6523 NP-5892
[Illinois. Univ., Urbana.]
ON THE TRANSITION METAL PHOSPHIDES. Interim Report from December 1953 to July 1955. S. S. Hsu, P. N. Yocom, and T. C. C. Cheng. 99p. Contract N6ori-071(50).

The preparation and crystal structure of the phosphides of Ni, Co, Cr, W, Mn, and Mo are described. Corrosion properties are also discussed. (C.W.H.)

6524 NP-5895
University of Southern Calif., Los Angeles.
PRINCIPLES OF INORGANIC POLYMERIZATION. IV. Progress Report No. 4. Anton B. Burg. Sept. 30, 1955. 9p. Project No. 5(7-7340). Contract AF33(616)-2743.

The reaction of B_5H_9 with $(CH_3)_2NP(CH_3)_2$ produces a yellow glass, of approximate composition $[B_4H_{3.4}Me_2P(Me_2N)_{0.9}]_x$ after three hours in vacuo at 404°C. At this temperature the glass has a glue-like viscosity and adhesion. The reaction products of CF_3PI_2 are $(CF_3)_2PI$ with mercury are quite numerous. Copolymers of the PF, CF_2, and CF_3P bifunctional units are being studied. It is concluded that CF_3PI_2 is stable to sunlight if protected from air, and that $NaCO_2CF_3$ is not a good reagent for producing CF_3-P-I compounds from $I_2 + P_x$. A new volatile compound purporting to be CF_3SNH_2 was obtained from CF_3SSCF_3 and NH_3. Diborane failed to react with CF_3SSCF_3 at 100°C. (See also WADC-TR-56-82.) (auth)

6525 NP-5896
Lehigh Univ., Bethlehem, Penna. Surface Chemistry Lab.
BASIC FACTORS IN THE FORMATION AND STABILITY OF NON-SOAP GREASES. Quarterly Progress Report No. 6 [for] October 15, 1955 to January 15, 1956. J. J. Chessick, A. C. Zettlemoyer, and C. Dodd. Jan. 15, 1956. 30p. Contract AF33(616)-2440.

Monthly Report No. 19 is incorporated with this report and will not be submitted separately.

Progress is reported in an investigation of the mechanism of gel formation. Several polar solids were investigated as thickeners in nonpolar grease vehicles. Results are also reported from a study of the influence of the straight chain, heptyl derivatives on the consistency of various non-soap grease systems. The mechanism of additive action was explained, at least qualitatively, in terms of the mechanism of flocculation of these solids in the simpler grease systems. (C.H.)

6526 NP-5898
Mine Safety Appliances Co., Callery, Penna.
SOLUBILITY OF SODIUM MONOXIDE IN NaK. Technical Report No. 47. S. J. Rodgers and J. W. Mausteller. Mar. 15, 1956. 9p. Contract NObs-65426.

The concentration of oxygen (added as Na_2O) in NaK-24 (24 wt.% potassium) and NaK-44 was studied as a function of temperature. Oxygen concentrations are higher for lower potassium NaK compositions, and are higher at higher temperatures. Curves are presented for oxygen concentration versus temperature and potassium content for NaK-24, NaK-44, and NaK-78. Up to 550°F, the oxygen concentrations are independent of potassium content of the sodium, but above 550°F the curves diverge to reach oxygen saturations at 1000°F of 0.20, 0.15, 0.085, and 0.050 wt. % O_2, respectively, for sodium, NaK-24, NaK-44 and NaK-78. These data can be applied to the problem of oxide precipitation by a leak from a third-fluid NaK system to a sodium system high in oxygen content. Below 0.010 wt.% O_2 in the sodium there would be no problem. Above this value precipitation would depend on the potassium content, temperature, and oxygen content, but the effect would be of little consequence in a well-designed sodium system. (auth)

6527 NP-5901
Clark Univ., Worcester, Mass.
STUDY OF EQUILIBRIA BETWEEN METAL IONS AND AMINO ACID COMPLEXING AGENTS IN AQUEOUS SOLUTION. Final Report. Arthur E. Martell. Dec. 1955. 24p. Project No. NR-052-286. Contract NONR-596(00).

The thermodynamic changes associated with the formation of alkaline-earth, rare-earth, and Mn chelates of ethylenediaminetetraacetic acid (EDTA) and related ligands are tabulated. Relative thermodynamic stability constants were also calculated for EDTA chelates of transition metals and rare earths. Chelate structure and theory of chelate formation are discussed. (C.W.H.)

6528 NP-5982
Rutgers Univ., New Brunswick, N. J. School of Chemistry.
RESEARCH ON BORON POLYMERS. Progress Report B-5 [for] February 1, 1956–May 10, 1956. William L. Ruigh, A. D. Olin, N. G. Steinberg, and P. A. van der Meulen. 27p. Project 5-(7-7340). Contract AF33(616)-2057.

The reaction between β-chlorovinylboron dichloride and NH_3 in benzene and ether was studied. Tri-B-β-chlorovinyl-borazole is the main product of the reaction, and appears to polymerize in the presence of polar solvents. The catalytic synthesis of phenylboron dichloride was also studied. (For preceding period see NP-6014.) (auth)

6529 NP-5995
University of Southern Calif., Los Angeles.
PRINCIPLES OF INORGANIC POLYMERIZATION. VII. Progress Report No. 7. Anton B. Burg. Apr. 30, 1956. 14p. Project No. 5(7-7340). Contract AF33(616)-2743.

A study is being made toward obtaining polymers wherein P carries larger groups. Further study of a previously reported ethylated phosphinoborine and the development of new phosphinamines for reaction with pentaborane-9, and the separation of high-temperature resin for tests of its adhesive quality are reported. Studies were continued on fluorocarbon-phosphorus compounds, the attachment of non-labile electronegative groups to B, and the dimethylamine chemistry of pentaborane-9. (J.E.D.)

6530 NP-6008
Brooklyn. Polytechnic Inst.
RELATIVE RATES OF SOME VERY RAPID GASEOUS BIMOLECULAR REACTIONS. Jerome Daen and R. A. Marcus. Apr. 1, 1956. 24p. Project No. NR 051-339. Contract Nonr-839(09).

A steady-state flow apparatus has been constructed which permits the measurement of relative rates of rapid gas phase bimolecular association reactions at very low pressures. Using this apparatus, the relative reactivities of the methylamines with BF_3 were determined over the pressure range 0.009 to 0.04 mm Hg. Within the experimental error the ratio of rate constants, $k_{(CH_3NH_2}/k_{(CH_3)_2N}$, was found to be pressure independent and to have a value of 1/12. A small number of experiments were made competing monomethylamine and dimethylamine for BF_3; for this system the ratio of rate constants, $k_{CH_3NH_2}/k_{(CH_3)_2NH}$ had an average value of 1/5. In addition to the above, experiments were made on various phenomena such as the sorption of BF_3 on various surfaces, the selectivity of a diffusion pump and the extent of base exchange reactions, insofar as these factors pertained to the understanding of the relative rate measurements. (auth)

6531 NP-6014
Rutgers Univ., New Brunswick, N. J. School of Chemistry.
RESEARCH ON BORON POLYMERS. Progress Report B-4 [for] December 1, 1955–February 1, 1956. William L. Ruigh, A. D. Olin, N. G. Steinberg, and P. A. van der

Meulen. 29p. Project 5-(7-7340). Contract AF33(616)-2057.

β-chlorovinylboron dichloride has been prepared from the reaction of acetylene with BCl_3 over a charcoal supported Hg_2Cl_2 catalyst. The continuous recirculation of BCl_3 in a specially constructed apparatus cut down the proportion of by-products to a negligibly small amount. The analyses of organoboron compounds is being investigated using the diethanolamine ester of benzeneboronic acid as a standard. (For preceding period see WADC-TR-55-26(Pt. III).) (auth)

6532 UCRL-3351

California. Univ., Berkeley. Radiation Lab.

CHEMISTRY DIVISION QUARTERLY REPORT [FOR] DECEMBER 1955, JANUARY, FEBRUARY 1956. Mar. 23, 1956. 73p. Contract W-7405-eng-48. $0.45(OTS).

Bio-organic Chemistry. Progress is reported in the following studies: the radioinduced decomposition of dry crystalline hemin; the design and construction of an electron paramagnetic resonance spectrometer; the radioinduced decomposition of choline chloride; tracer studies on the biosynthesis of adenines in mice; tracer studies on the site of fatty acid synthesis in rats; the influence of cerebral cholinesterase level on behavior in rats; the preparation of C^{14}-labeled valine and measurement of the respiratory excretion pattern of valine in rats; the preparation of C^{14}-labeled methionine and measurement of the respiratory excretion pattern of methionine in rats; tracer studies on the metabolism of adenine in rats and the influence of developing tumors on adenine metabolism; the metabolism of sodium acetates in mice infected with poliomyelitis virus; design of equipment for the laboratory culture of algae; the chromatographic determination of photosynthetic products formed by algae, and studies on P^{32} incorporation by algae; studies of the properties and cofactors for carboxydismutase; and the identification of iron-chlorophyl compounds in green plants. Nuclear Chemistry. Modifications in the 20-cm spectrometer are outlined. Decay schemes for Th^{227}, Gd^{149}, and Gd^{147} are presented. The alpha-to-electron capture branching ratio of Tb^{149} and the anion exchange separations of Mo and Tc and of Re and W were studied. A heat of formation for FeO_4^{2-} of 70 kcal was determined calorimetrically. (For preceding period see UCRL-3240.) (C.H.)

6533 AEC-tr-2483

OXYGEN DEPOLARIZATION ON AN IRON POROUS ELECTRODE. A. A. Edigarian and N. N. Voronin. Translated from Ukrain. Khim. Zhur. 21, 195-205(1955). 20p.

Depolarization of cathodic formations of hydrogen by oxygen on Fe metals has been investigated. Porous iron electrodes permitting the flow of air through the pores of the electrodes to the supporting surfaces were used in reduction of atmospheric oxygen on porous iron. Heat treatments of electrodes in a H atmosphere improved the corrosion resistance and depolarization capacity of the electrodes. (R.V.J.)

6534 AEC-tr-2519

COORDINATION BETWEEN NUCLEI FORMATION AND CRYSTAL GROWTH. J. A. Christiansen and A. E. Nielsen. Translated by D. E. Cardamone from Z. Electrochem. 56, 465-7(1952). 6p.

In some analytical precipitation reactions, the precipitation time t, in equivalent concentrations, is expressed by the function $\lambda t_f = C_o^{-p+1}$ (λ and p are constants, t_f the precipitation time, and C_o the initial concentration). This equation is proven, discussed, and interpreted. (D.E.B.)

6535 AEC-tr-2523

EFFECT OF CERTAIN ADDITIONS ON THE RATE OF REDUCTION OF OXIDES OF NICKEL, MERCURY, AND COBALT. A. T. Sgibnev. Translated from Zhur. Fiz. Khim. 28, 1770-3(1954). 6p.

Study was made of the effects of certain additions of solid substances on the rate of reduction of oxides of Ni, Co, and Hg with H. Certain conclusions were reached concerning the mechanism of the investigated process of metallic oxide reduction with additional solid substances. A considerable increase was noted in the reaction rates of reduction of Ni_3O_4, and HgO in the presence of cupric oxide. $Al(OH)_3$ retarded the reduction of oxides of Ni and Co. On the contrary, the reduction of HgO in the presence of $Al(OH)_3$ proceeded vigorously. (auth)

6536 AERE-Lib/Trans-574

THE ADSORPTION OF MERCURY VAPOUR BY SOME ADSORBENTS AND CATALYSTS. E. V. Alekseeskii. Translated by J. B. Sykes from pp. 245-9 of Trans. 6th Mendeleev Congr. Theoret. and Appl. Chem., Kharkov, 1932. Vol. II, Pt. I.

An extensive investigation of the adsorption of Hg has been made. Adsorption by bone charcoal, activated wood charcoal, Al_2O_3, clay, Hopcalite, MnO_2, Co_2O_3, and Zn was followed for periods up to five years. MnO_2 is shown to be the most efficient Hg adsorbent. Experimental methods are described. (D.E.B.)

6537 AERE-Lib/Trans-595

THE NATURE OF THE CONDUCTIVITY OF NON-AQUEOUS SOLUTIONS. M. Ussanowitsch. Translated by R. S. Forsyth from Acta Physicochim. U.R.S.S. 2, 239-71(1935). 21p.

A study was made of the electric conductivity and the temperature coefficients of conductivity of ethyl ethers, arsenic chlorides and acid systems. (R.V.J.)

6538 AERE-Lib/Trans-640

ELECTROCHEMICAL INVESTIGATIONS ON ETHEREAL SOLUTIONS. II. THE SYSTEM: ARSENIC TRICHLORIDE-DIETHYL ETHER. M. Ussanowitsch. Translated by F. Hudswell from Z. physik. Chem. 140A, 429-34(1929). 7p.

The molecular conductivity and decomposition potential have been determined for solutions of $AsCl_3$ in Et_2O. (auth)

6539 AERE-Lib/Trans-679

ON THE KINETICS OF HETEROGENEOUS EXCHANGE REACTIONS. I. STUDIES OF SOLID BODIES BY MEANS OF ISOTOPIC EXCHANGE. Karl-Erik Zimens (Zimen). Translated by F. Hudswell from Arkiv Kemi Mineral. Geol. 20A, 1-26(1945). 22p.

6540

THE SOLUBILITY OF SILVER SULFATE IN SULFURIC ACID MEDIA AT HIGH TEMPERATURES. EFFECTS ON THE SILVER, SILVER SULFATE ELECTRODE. M. H. Lietzke and R. W. Stoughton (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 78, 3023-5(1956) July 5.

The solubility of Ag_2SO_4 has been determined in H_2O and in 0.1, 0.5, and 1.0M H_2SO_4 to above 250° in order to evaluate the useful range of the Ag, Ag_2SO_4 electrode in acid solutions. The effects of the increase in solubility with increasing temperature and H_2SO_4 concentration are discussed. Calculated solubilities in H_2SO_4 media based on the decrease in the HSO_4^- acid constant with temperature are compared with the observed values. (auth)

6541

THE STANDARD POTENTIAL OF TITANIUM. Shun-ichi Satoh and Koshin Yamane. J. Sci. Research Inst. (Tokyo) 50, 43-50(1956) Mar.

The theoretical value of the standard potential of Ti is 1.30 v; an experimental value obtained for the standard potential of Ti in $Ti_2(SO_4)_3$ solution is 0.355 v. The discrepancy between the calculated and observed values is attributed to the irreversible nature of the Ti electrode. The calculated value is accepted as the standard potential. (C.W.H.)

6542
POLONIUM OXIDES. E. A. Terent'ev (All Union Inst. of Scientific and Technical Infor. Academy of Science) Priroda, 45, 84(1956) Feb. (In Russian).

Experiments determined that PoO_2 obtained from oxygen oxidation of metallic Po and the oxide produced from decomposition of polonium nitrate are identical. This oxide exists in two crystalline forms. The first is stable only for a short period and possesses tetragonal structure; the second is more stable and has structure similar to fluorine. (R.V.J.)

Refer also to abstract 6749.

AEROSOLS

6543 AERE-HP/M-89
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
A PORTABLE SELF-CONTAINED AIR SAMPLER FOR EMERGENCY USE. R. F. Hounam. Sept. 16, 1954. 8p.

An apparatus for sampling air-borne dust is described which is based on an air ejector operated by compressed air from an oxygen cylinder. It is capable of sampling 100 liters of air per min for a period of about 20 min. (auth)

ANALYTICAL PROCEDURES

6544 AD-65277
Dugway Proving Ground, Tooele, Utah.
FLUORESCENCE QUENCHING AS AN ANALYTICAL METHOD FOR THE DETERMINATION OF HYDROGEN FLUORIDE. CW Scientific Report No. 12. John D. Salzman, W. S. Haynes, and Marilyn G. Alder. Feb. 14, 1955. 45p.

The quenching of the fluorescence of a magnesium oxinate solution by HF was used as the basis of an analytical procedure for the determination of HF in solutions and in phosphonofluoridates. (C.W.H.)

6545 AERE-C/R-1865
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE VOLUMETRIC ANALYSIS OF THORIUM–TUNGSTEN SOLUTIONS. G. W. C. Milner and G. A. Barnett. Apr. 1956. 10p.

The complete analysis of mixtures of thorium and tungsten can be readily accomplished by titration procedures. The method for thorium involves the addition of sufficient ethylenediaminetetraacetic acid to complex this constituent and leave a small amount in excess. Then, after the adjustment of the pH of the solution to a value of 2.8, this excess is determined by titration with a standard thorium nitrate solution using an absorptiometer to locate the end point and alizarin red S as the indicator. Interference from tungsten is prevented by complexation with hydrogen peroxide. The tungsten content is determined on on a separate aliquot by precipitating tungsten 8-hydroxyquinolate, while retaining thorium in solution as its stable complex with EDTA. After filtration the precipitate is dissolved in sodium hydroxide and this solution is made acid with hydrochloric acid after the addition of oxalic acid to prevent the precipitation of tungstic acid. The 8-hydroxyquinoline content of the precipitate is finally determined by the usual bromate titration method. (auth)

6546 AERE-GP/M-153
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
X-RAY DIFFRACTION EXAMINATION OF CaF_2 SLAG (SPRINGFIELDS). J. Adam. June 16, 1953. 7p.

In the process of U preparation from UF_4, a certain amount of U is retained in the CaF_2 slag which cannot be recovered by leaching. An x-ray-diffraction study of the slag suggests some U compound forms a solid solution with CaF_2, possibly UN_2 or UO_2. (D.E.B.)

6547 CCC-1024-TR-175
Pennsylvania State Univ., University Park.
USE OF ANION EXCHANGE RESINS IN THE DETERMINATION OF BORON. J. R. Hayes and J. D. Wolszon. Mar. 1, 1956. 46p. [For Callery Chemical Co. Contract NOa(s)-52-1024-c].

A procedure is presented for the determination of boron in aqueous solutions. Boron is separated by adsorption on a resin bed containing a weakly basic anion resin (OH^- form) and a strongly acidic cation resin (H^+ form); the bed is rinsed with distilled H_2O, and the boron in the effluent is analyzed by titration with base using invert sugar as the activating agent. (C.W.H.)

6548 NAA-SR-1509
Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.
EXPERIMENTAL TECHNIQUES FOR THE DETERMINATION OF OXYGEN IN SODIUM AND IN NaK BY THE BUTYL BROMIDE METHOD. Louis Silverman and Mary Shideler. June 15, 1956. 15p. Contract AT-11-1-GEN-8. $3.30(ph OTS); $2.40(mf OTS).

Modifications are suggested for the butyl bromide method for determining O_2 in Na. Tools for breaking the glass capsule and for cutting the Na are described. Chromatographic purification of the organic reagents by use of silica-gel was found to be effective and far more rapid than earlier purification methods. Data are included which show the effectiveness of this type of purification and which list the appropriate drying agents. Liquid Na–K alloy can be handled by initially freezing the alloy and then controlling the speed of reaction by the temperature. After the K has reacted, the rate of Na reaction is accelerated by increasing the content of the butyl bromide. (auth)

6549 USNRDL-TR-83
Naval Radiological Defense Lab., San Francisco.
A FLAME PHOTOMETRIC APPARATUS FOR THE DETERMINATION OF RADIOACTIVE MATERIALS. M. Honma. Apr. 24, 1956. 16p. Project NS 081-001.

A triple-filter apparatus has been devised to be used with the flame photometer in which the radioactive particles are filtered out before the exhaust gases are discharged. The operational techniques for the apparatus are discussed. A table showing the contamination of the various parts of the apparatus after an 80-hr run is presented. (auth)

6550 AEC-tr-2521
PURE SILICON. H. V. Wartenberg. Translated from Z. anorg. u. allgem. Chem. 283, 372-6(1956). 7p.

When $SiCl_4$ is conducted over molten Si in a quartz vessel, the metallic impurities of Si such as Al, Zn, etc., can be volatilized as chlorides (not B). This has been determined by calculations and by experiment. This way the impurities may be reduced to less than 0.01%. But Si molten in SiO_2 contains still some tenth of % of SiO_2 by way of dissolved SiO. The melting point of Si is 1423°C. (auth)

6551 AERE-Lib/Trans-742
PRECIPITATION OF METALS WITH AMINOPHENYL-ARSONIC ACIDS. R. Pietsch. Translated by F. Hudswell from Mikrochim. Acta, Nos. 5/6, 954-61(1955). 9p.

The precipitation of metallic ions with the isomeric o, m, and p-aminophenyl-arsonic acids is described and color reactions which take place are quoted. Differences in the formation of precipitates are pointed out and these can be

made use of for separation. The effect of the position of the amino group on the precipitation is discussed. (auth)

6552 AERE-Lib/Trans-743

PRECIPITATION OF METALS WITH NITRO PHENYL ARSONIC ACIDS. R. Pietsch. Translated by F. Hudswell from Mikrochim. Acta, Nos. 5/6, 1019-25(1955). 8p.

The qualitative precipitation of metal ions by means of the 3 isomeric, ortho, meta and para, nitrophenylarsonic acids are described. Differences in the pH values at the beginning of precipitation are pointed out. The effect of the position of the nitro-group on the beginning of precipitation is emphasized. (auth)

6553

DETERMINATION OF STRONTIUM IN SEA WATER BY USING BOTH RADIOACTIVE AND STABLE ISOTOPES. R. W. Hummel and A. A. Smales (Atomic Energy Research Establishment, Harwell, Berks, England). Analyst 81, 110-13(1956) Feb.

An average value of ~8.1 mg/l was obtained for the Sr content in North Atlantic sea water by radioactivation and isotope dilution techniques. (C.W.H.)

6554

THE NATURE OF NIOBIUM(V) IN HYDROCHLORIC ACID SOLUTION. J. H. Kanzelmeyer, Jack Ryan, and Harry Freund (Oregon State Coll., Corvallis). J. Am. Chem. Soc. 78, 3020-3(1956) July 5.

The nature and dependency of Nb species in solutions of varying H^+, Cl^-, and HCl are studied. Only three soluble chloride species appear to exist to any extent in these systems: $Nb(OH)_2Cl_4^-$ in high Cl^- and high H^+; $Nb(OH)Cl_3^+$ in extremely high H^+ and low Cl^- and $Nb(OH)_2Cl_3$ at H^+ and Cl^- in the range of three molar. Decreasing H^+ at high Cl^- results in colloid formation. (auth)

6555

RADIOCHEMICAL METHODS IN ANALYSIS. M. J. Cabell and A. A. Smales (Atomic Energy Research Establishment, Harwell, Berks, England). Research (London) 9, 214-19 (1956) June.

6556

POLAROGRAPHIC INVESTIGATIONS OF ELECTROLYTIC REDUCTION OF NIOBIUM AND TITANIUM FROM SULFATE SOLUTIONS. E. I. Krylov and V. S. Klevatova (Kirov Ural Polytecknic Inst.). Zhur. Anal. Khim. 11, 144-8(1956) Mar.-Apr. (In Russian)

Results are given for the process of Nb^{5+} and Ti^{4+} reduction in 70% H_2SO_4 on a dropping mercury electrode. The analysis of polarograms according to the straight line inclination in coordinates E, $lg_i(i/d-i)$ shows the irreversibility of the reduction process has also been confirmed by alteration of the half-wave potentials of Nb^{5+} and Ti^{4+} shifting with temperature increase in the direction of more positive values. (tr-auth)

6557

METHODS OF VANADIUM CARBIDE ANALYSIS. M. A. Gurevich, B. F. Ormont, and M. Z. Nokhimovskaya (Karpov Moscow Inst. of Phys.-Chemistry). Zhur. Anal. Khim. 11, 177-9(1956) Mar.-Apr. (In Russian)

Vanadium in V carbides has been determined by a gravimetric method. The optimum burning temperature was 950°. The total carbon and undissolved free carbon were determined by the volumetric method; the absorption of CO_2 by titrated solution of $Ba(OH)_2$ with a back titration of the excess of $Ba(OH)_2$ in a solution of hydrochloric acid. The free carbon was determined by V-carbide dissolution in nitric acid. (tr-auth)

Refer also to abstracts 6571, 6611, and 6709.

DEUTERIUM AND DEUTERIUM COMPOUNDS

6558 A-359

Northwestern Univ., Evanston, Ill.

CONTINUOUS DEUTERIUM ANALYSIS. Final Report. Malcolm Dole, R. L. Burwell, Jr., R. J. Voskuyl, and W. E. Roake. Nov. 4, 1942. Decl. June 17, 1954. 35p. Contract OEMsr-482. $6.30(ph OTS); $3.00(mf OTS).

The research problem presented was the development of an apparatus for the continuous determination of deuterium in small concentration and the development of a method for the purification of water which must precede the deuterium analysis. (auth)

6559 NBS-4611

National Bureau of Standards, Washington, D. C.

A REVIEW OF THE REACTION KINETICS OF DEUTERIUM AND TRITIUM COMPOUNDS. IV. EXCHANGE AND SUBSTITUTION REACTIONS. Lawrence M. Brown. May 25, 1956. 86p. Project No. 0302-10-2641. $0.50 (OTS).

6560

HEAVY-WATER PRODUCTION METHODS. A SURVEY OF SOME KNOWN PROCESSES. Nuclear Power 1, 9-16(1956) May.

Information on current methods of heavy-water production is severely restricted. Nevertheless, working on published data, it is possible to build up some kind of picture of the present position which might not be too far from the truth. After discussion of the principles involved, the article describes in some detail plants which have been used for heavy-water production or which are projected, and concludes with some suggestions on the form which future plants might take. (auth)

6561

THE REACTIONS OF TRIFLUOROMETHYL RADICALS WITH HYDROGEN ISOTOPES. P. B. Ayscough and J. C. Polanyi (National Research Council, Ottawa, Canada and Princeton Univ., N. J.). Trans. Faraday Soc. 52, 960-70 (1956) July.

The photolytic decomposition of hexafluoroacetone has been used to produce trifluoromethyl radicals for a study of their reactions with hydrogen isotopes. Activation energies for the four reactions: $CF_3 + H_2 \rightarrow CF_3H$, $CF_3 + HD \rightarrow CF_3H$, $CF_3 + HD \rightarrow CF_3D$, and $CF_3 + D_2 \rightarrow CF_3D$ were found to be, respectively, 9.5 ± 0.7, 10.5 ± 1.5, 10.2 ± 1.5, and 10.2 ± 0.7 kcal/mole. The results are discussed in detail in terms of the collision theory and the absolute theory of reaction rates. Evidence is adduced for a progressive decline in pre-exponential factor down the series of reactions: $H + H_2$, $CH_3 + H_2$, and $CF_3 + H_2$. (auth)

Refer also to abstracts 6923, 7084, and 7086.

FLUORINE AND FLUORINE COMPOUNDS

6562 AD-75098

Louisiana State Univ., Baton Rouge.

A SURVEY OF LITERATURE ON THE DETECTION OF FLUORIDE ION AND POSSIBLE RESEARCH LINES. Monthly Report No. 6 for the Period Ending August 31, 1955. James W. Robinson and Philip W. West. 10p. Contract DA18-108-CML-5587.

6563 AD-75099

Louisiana State Univ., Baton Rouge.

PRELIMINARY EXPERIMENTAL WORK ON THE DETECTION OF FLUORIDE ION. Seventh Monthly Report of Research for the Period Ending September 30, 1955.

James W. Robinson and Philip W. West. 15p. Contract DA-18-108-CML-5587. (ETF-107-94-15/7a).

Four methods of detecting fluoride were investigated. These included detection after evolution of SiF_4; detection with Zr-alizarin reagent; detection with Fe-thiocyanate reagent; and detection with organic dyes. Each method was found to be capable of detecting fluoride. However, there was some inherent difficulty with the first three methods which prevented their use under field conditions. The fourth method was not sensitive enough to be useful. (auth)

6564 NP-6022

Stanford Research Inst., Menlo Park, Calif.

THE THERMODYNAMIC PROPERTIES OF MOLTEN SALTS. Bimonthly Progress Report No. 8 for April–May 1956. Orlo E. Myers. June 11, 1956. 7p. SRI Project No. SU-1102. Contract AF-33(616)-2558.

Work is in progress to determine absolute entropies and heats and free energies of formation of selected inorganic fluorides by measuring heat capacities and heats of solution within a closed thermodynamic cycle. Final adjustment of a drop calorimeter for integral heat capacity determinations above room temperature and its use with NbF_5 up to 190°C are described. Preliminary evidence has been obtained that the heat of fusion of this material is unexpectedly low. New solution calorimetry techniques have been devised for use with these highly corrosive and hygroscopic fluorides. A new solution calorimeter has been constructed and is ready for use. (auth)

6565 WADC-PR-55-3

Pennsylvania Salt Mfg. Co., Philadelphia.

PREPARATION OF POLYMERS FROM HALOGEN-CONTAINING OLEFIN AND DIENE MONOMERS. Progress Report [for] January 1956 to March 1956. H. Iserson and F. E. Lawlor. Mar. 1956. 20p. Project 9-00024-65. Contract AF33(616)-3137.

The synthesis of the following compounds is described: $CF_2 = CFCCl = CHCl$, $CF_2 = CFCCl = CCl_2$, $CF_2BrCFClCCl = CH_2$, and $CF_3CH_2OCH = CH_2$. A soft rubber was formed by copolymerizing perfluoropropene with $CF_3CH_2OCH = CH_2$. (See also WADC-PR-55-1.) (auth)

6566

METAL FLUORIDES AS ACIDS IN THE HYDROGEN FLUORIDE SYSTEM. D. A. McCaulay, W. S. Higley, and A. P. Lien (Standard Oil Co. of Indiana, Whiting). J. Am. Chem. Soc. 78, 3009-11(1956) July 5.

Various metal fluorides and other metal salts were evaluated as acids in the HF system. In each test, a mixture of m- and p-xylene was treated with HF plus the metal salt. In this medium, a fluoride may act as a Lewis acid and coördinate with a fluoride ion. The proton released then adds preferentially to m-xylene. Three fluorides proved to be strong acids: TiF_4, NbF_5, and TaF_5. Phosphorus pentafluoride acted as a weak acid. The acidity of the fluorides was attributed to the high positive valence of the metal and its ability to form covalent bonds with fluorine. All acidic fluorides show about the same preference for m-xylene vs. p-xylene as does BF_3. The acid $HF-TiF_4$ also extracts, isomerizes and disproportionates arenes in the same manner as $HF-BF_3$. The arene cation is therefore the same regardless of the metal fluoride present. (auth)

Refer also to abstract 6544.

GRAPHITE

6567 OSR-TN-55-312

Utah. Univ., Salt Lake City.

REACTION KINETICS OF GRAPHITE OXIDATION AT LOW TEMPERATURES. Arthur L. Ruoff and Henry Eyring. Aug. 1955. 27p. Contract AF33(038)-20839. (AD-72229).

Additional data on the oxidation kinetics of graphite by O_2 are reported. Using the available data concerning this reaction and applying absolute reaction rate theory it was shown that adsorption is the rate-controlling step. (auth)

6568

PROPERTIES OF GRAPHITE. E. A. Smith. Nuclear Eng. 1, 125-7(1956) June.

Examination of graphite structure shows desirable characteristics for lubrication or constructional work. The mechanical, thermal and electrical properties are discussed in relation to changes of temperature. Purity is a function of raw materials. (auth)

LABORATORIES AND EQUIPMENT

6569 NAA-SR-1227

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

HOT CELL APPARATUS FOR PYROPROCESSING EXPERIMENTS. James R. Foltz, Weldon J. Gardner, and Fred D. Rosen. June 15, 1956. 67p. Contract AT-11-1-GEN-8. $10.80(ph OTS); $3.90(mf OTS).

Apparatus for performing experiments on high-temperature processing by remote methods is described. Techniques for control of radioactive contamination are discussed. A description of the shielded enclosure is also given. (auth)

6570 AEC-tr-2479

BEHAVIOR OF THE GLASS TIN–SODIUM ELECTRODE IN VARIOUS MOLTEN SALTS. A. A. Kolotii. Translated from Ukrain. Khim. Zhur. 20, 502-7(1954). 13p.

The glass tin–sodium electrode is very sensitive to small concentrations of Na^+ in molten PbI_2; the value of the electrode potential in the range of concentrations of 35 to 50 mol. % of NaCl and 60 mol. % (and higher) of NaBr is almost constant. (auth)

6571 AERE-Lib/Trans-529

ON THE THEORY OF A HIGH-FREQUENCY TITRIMETER WITH A FREQUENCY INDICATOR. R. Huber and K. Cruse. Translated by J. B. Sykes from Z. Elektrochem. 58, 156-61 (1954). 13p.

The effects of the conductivity and dielectric constant of a capacity cell in the oscillation circuit on its resonance frequency are calculated. The limits of the displacement of the optimum concentration range by alteration of the fundamental frequency and of the cell are obtained theoretically and verified by comparison with experiment. The theoretical treatment of induction cells is indicated. (auth)

MOLECULAR STRUCTURE

6572 NP-6011

Maryland. Univ., College Park.

A QUANTUM MECHANICAL DERIVATION OF AN INTERNUCLEAR POTENTIAL FUNCTION FOR POLYELECTRONIC BONDS. Technical Report No. 2. Ellis R. Lippincott. Apr. 1956. 38p. Contract DA-36-034-ORD-2175.

A simple quantum mechanical model of bond formation is presented which allows the derivation of an internuclear potential function of the form $V = -D_e \exp^{-}[-n\Delta R^2/2R]$ where $n = k_e R_e/D_e$. The method makes use of a delta function model whereby bond formation is described by the shifting of atomic delta functions into molecular delta functions. The predicted results for H_2^+ are nearly exact for all bond properties while the results for H_2 are more

accurate than those of all but the most elaborate methods used previously. In particular the method appears superior to both the valence bond and molecular orbital theories in both results and ease of calculation. Advantages of the method are that the same form for the internuclear potential is obtained for polyelectronic bonds as for one and two electron bonds, and that polyelectronic bond systems can be handled by one-dimensional methods. Theoretical values for the parameter, n, for polyelectronic molecules are calculated which agree well with values obtained from experimental data. (auth)

6573

MOLECULAR FORCE FIELDS. PART 16. FORCE CONSTANTS IN SOME NON-LINEAR TRIATOMIC MOLECULES. S. Smith and J. W. Linnett (Inorganic Chemistry Lab., Oxford, England). Trans. Faraday Soc. 52, 891-903(1956) July.

The general force field for bent YX_2 molecules involves four constants. Therefore with the three vibration frequencies usually available, it is not possible to determine a unique set of the four constants. The relationships between the two main and two cross-term constants were determined using a valency force field type potential energy function, for H_2O, D_2O, H_2S, D_2S, H_2Se, D_2Se, NO_2, NO_2^-, O_3, SO_2, Cl_2O, and ClO_2. In some cases it has been possible to choose a most likely set of four constants by fixing the value of the bond stretching constant by comparison with data for the corresponding diatomic molecule using a Clark type relationship. In others, analogies between the various molecules can be used to choose very approximate values for the constants. Finally the significance of the results obtained has been discussed. In particular, the signs and values of the cross-term constants have been considered, and possible explanations, such as repulsion between the non-bonded atoms, have been examined. (auth)

RADIATION CHEMISTRY

6574 JENER-40

Joint Establishment for Nuclear Energy Research, Kjeller, Norway.

ON THE CHEMICAL STATES OF RADIOACTIVE PHOSPHORUS-32 EXTRACTED INTO WATER FROM PILE-IRRADIATED SULPHUR. J. B. Dahl. Apr. 26, 1956. 23p.

Samples of the aqueous solution contained at the end of the extraction process ~ 99.5% of the P^{32} activity bound as orthophosphoric acid. Corresponding analysis of the solution after evaporation to a suitable volume, contained 1 to 2% orthophosphoric acid, dependent on the temperature used. (auth)

6575 AERE-Lib/Trans-723

EFFECT OF GAMMA RADIATION FROM RADIOACTIVE COBALT ON CARBOHYDRATES. M. A. Khenokh. Translated by S. Botcharsky from Doklady Akad. Nauk S.S.S.R. 104, 746-9(1955). 7p.

6576

EFFECTS OF γ-RADIATION ON ICE. J. A. Ghormley and A. C. Stewart (Oak Ridge National Lab., Tenn.). J. Am. Chem. Soc. 78, 2934-9(1956) July 5.

The γ-ray induced formation and disappearance of H_2O_2 in ice was investigated as a function of total dose, temperature, dissolved gas and thermal cycling with intermittent irradiation. When oxygen-saturated water was frozen rapidly and irradiated with cobalt-60 γ-rays, analysis of the melted samples gave the following results. The initial 100 ev yield of hydrogen peroxide increased from 0.2 below −200° to 0.7 at −15°. The hydrogen yield increased from 0.1 below −100° to 0.25 at −15°. Long irradiations at −196° resulted in continued build up of hydrogen peroxide and hydrogen to at least 10^{-3} M while at higher temperatures steady states were reached at much lower concentrations of products. The initial presence of oxygen or hydrogen had little effect on hydrogen peroxide observed after irradiations at −196° but had considerable effect on hydrogen peroxide production at higher temperatures. When samples prepared by freezing hydrogen-saturated 50 μM hydrogen peroxide solution were irradiated for short times at temperatures from −220 to −5°, the hydrogen peroxide concentration was observed to decrease at all irradiation temperatures. The initial 100 e.v. yield for peroxide disappearance increased from 0.6 at −100° to 4.0 at −60°. When a sample initially containing hydrogen and hydrogen peroxide was subjected to two short irradiations at −196° and was allowed to warm to −180° or above between irradiations, the observed final concentration of hydrogen peroxide was less than that for an equivalent irradiation with the sample held at −196°. The greater disappearance of hydrogen peroxide with intermittent warming is attributed to reaction induced by release of some reactive species trapped during irradiation at the low temperature. Ice irradiated at −196° exhibited an absorption peak at 2800 A. which on warming at a rate of 10° per min. disappeared below −143°. (auth)

6577

X-RAY INDUCED $Tl^{+++}-Tl^{+}$ EXCHANGE IN 0.8 N H_2SO_4. George E. Challenger and Burton J. Masters (Los Alamos Scientific Lab., N. Mex.). J. Am. Chem. Soc. 78, 3012-18 (1956) July 5.

The $Tl^{+}-Tl^{3+}$ isotopic exchange reaction in 0.8 N H_2SO_4 solutions undergoing irradiation with 50 kvp x-rays was studied. Throughout the range of the measurements, the radiation-induced exchange rate was found to be independent of thallous concentration, 0.503-order dependent upon thallic concentration, and 0.670-order dependent upon irradiation intensity. The results are explained in terms of a proposed mechanism involving the formation of the intermediate species Tl^{2+} at an appreciable steady-state concentration in the irradiated solutions. The Tl^{2+} intermediate is presumed to exchange rapidly with Tl^{+} and somewhat less readily with Tl^{3+}. In the absence of radiation, ferrocyanide ion was found to induce an exchange in $Tl^{+}-Tl^{3+}$ solutions, indicating that Tl^{2+} may be an important intermediate in the $Tl^{3+}-Fe(CN)_6^{4-}$ oxidation-reduction reaction. In order to study the x-ray induced exchange, it was necessary to measure the "thermal" electron exchange rate in these solutions. The "thermal" rate was found to be first order both in $[Tl^{+}]$ and in $[Tl^{3+}]$. A bimolecular rate constant of 1.19 liter/mole min at 25° was measured. The energy of activation was found to be 13.8 kcal/mol, and the entropy of activation, −22 eu. (auth)

6578

THE RADIATION CHEMISTRY OF WATER VAPOR. THE INDIRECT EFFECT OF DEUTERIUM. Richard F. Firestone (Argonne National Lab., Lemont, Ill.). J. Am. Chem. Soc. 78, 3226-7(1956) July 5.

The rate of formation of HD in gaseous mixtures of HTO and D_2 was shown to be directly proportional to rate of formation of hydrogen atoms. G(HD) values for samples irradiated to 10% exchange averaged 11 molecules/100 ev. (C.W.H.)

6579

ORGANIC RADIATION REACTIONS WITH DISSOLVED RADIOACTIVE IODINE. Warren W. Miller, Edward P. Rack, Elliot Burrell, and Conrad N. Trumbore (Pennsylvania State Univ., University Park). J. Chem. Phys. 23, 2457-8 (1955) Dec.

The radiation-induced reactions between molecular iodine

and several organic compounds (CCl_4, C_6H_{12}, C_2H_5I, and CS_2) using dissolved I_2^{131} as the radiation source were investigated. The rate constant for the CCl_4 reaction is estimated to be 0.059 (mc decay/ml)$^{-1}$. No reaction was observed with CS_2. (C.W.H.)

6580

THEORY OF RADIATION CHEMISTRY. III. RADICAL REACTION MECHANISM IN THE TRACKS OF IONIZING RADIATIONS. A. K. Ganguly and J. L. Magee (Univ. of Notre Dame, Ind.). J. Chem. Phys. 25, 129-34(1956) July.

A model is developed for the dissipation of the tracks of high-energy particles. It is assumed that all chemical effects are due to one kind of radical and that there are no effects of overlapping of neighboring tracks, i.e., that there is a sufficiently high concentration of scavenger to prevent such overlapping. The model of Samuel and Magee is used and extended to take into account the interaction of randomly distributed spurs along the track. Calculated values of the extent of scavenger reactions and radical reactions are presented in graphical form. General trends of experimental results to be expected according to the model are indicated. Quantitative correlation with experiments was not attempted because of the uncertainty in the values of various parameters used and because of the serious limitations of the one-radical model of tracks. (auth)

Refer also to abstracts 6882 and 7018.

RADIATION EFFECTS

6581 ORNL-1720

Oak Ridge National Lab., Tenn.

EFFECTS OF GAMMA RADIATION ON EXPLOSIVES. Final and Summary Report on Army Ordnance Project TA3-5003R; Stability and Reactions of Explosives. H. Rosenwasser. Dec. 6, 1955. 28p. Contract W-7405-eng-26. $0.25(OTS).

Work performed by members of the Technical Div., Picatinny Arsenal in collaboration with Oak Ridge National Lab.

The effects of gamma radiation on explosives by the Oak Ridge National Laboratory and the Picatinny Arsenal are reported. The data obtained by subjecting different explosives at various temperatures to the influence of an intense γ-ray field are presented. The work showed that the different explosives exhibited varied resistances to the treatment and gave an indication of the direction future work should follow. Explanation is required for the sensitization of the primers and detonators used, as well as the peculiar characteristic of gas formation by some of the explosives following irradiation. More generally, however, a need for a study of the radiation chemistry of explosives is indicated. It is hoped that provision will be made for such a study. (auth)

6582

EFFECT OF GAMMA RADIATION ON AQUEOUS ETHYLENE-OXYGEN SOLUTIONS. Ernest J. Henley, Wesley P. Schiffries, and Nathaniel F. Barr (Columbia Univ., New York). A.I.Ch.E. Journal 2, 211-14(1956) June.

Mixtures of ethylene and oxygen dissolved in water under pressures ranging from 200 to 700 lb./in.^{2} were irradiated with Co^{60} gamma rays at a dose rate of 180,000 r/hr. G values (molecules/100 ev.) for aldehyde production as high as 200 were observed. Increasing total pressure and dose were found to decrease these G values. Alcohol, acids, hydrogen peroxide, and organic peroxide are also products of the reaction; however, the yields are much smaller. (auth)

6583

γ-RAY INITIATED POLYMERIZATION OF CRYSTALLINE MONOMERS. A. J. Restaino, R. B. Mesrobian, H. Morawetz, D. S. Ballantine, G. J. Dienes, and D. J. Metz (Polytechnic Inst. of Brooklyn, N. Y. and Brookhaven National Lab., Upton, N. Y.). J. Am. Chem. Soc. 78, 2939-43(1956) July 5.

Acrylamide, methacrylamide, methylene-bis-acrylamide, vinyl carbazole, vinyl stearate, acrylic acid, methacrylic acid, and potassium, calcium and barium acrylates have been polymerized in the solid state by irradiation with γ-rays. The molecular weight of polyacrylamide obtained at low conversion was constant over a 270-fold variation of radiation intensity and in the temperature range 20 to 65°, but increased slightly with the energy of the radiation. The polymerization rate, however, was linear with field intensity, independent of the energy of radiation and had an over-all activation energy of 4.7 kcal/mole. Irradiation of acrylamide at −179° produced "frozen-in" radicals in concentrations of the order of 10^{-4} molal. In the polymerization of vinyl stearate the temperature dependences of rate and molecular weight exhibit a discontinuity on passing through the melting point of the monomer. With barium acrylate there is no significant variation in polymerization rate between 10 and 65°. Crystalline maleic anhydride, allylamine hydrochloride and picrate, and stilbene did not polymerize on exposure to γ-rays. (auth)

RARE EARTHS AND RARE-EARTH COMPOUNDS

6584

PRASEODYMIUM OXIDES. III. THE HEATS OF FORMATION OF SEVERAL OXIDES. C. T. Stubblefield, H. Eick, and L. Eyring (State Univ. of Iowa, Iowa City). J. Am. Chem. Soc. 78, 3018-20(1956) July 5.

Several stable oxides were prepared, including four of non-stoichiometric composition, and their heat of solution measured in an adiabatic microcalorimeter. The molal heats of reaction at 25° in 6.00 M HNO_3 of $PrO_{1.500}$ (A form), $PrO_{1.703}$, $PrO_{1.711}$, $PrO_{1.804}$ and $PrO_{1.833}$ were found to be −53.5 ± 0.1, −47.9 ± 0.1, −47.4 ± 0.4, −44.9 ± 0.1 and 43.8 ± 0.1 kcal., respectively. These values when combined with other data yielded the corresponding molal heats of formation for PrO_x of −217.9 ± 0.8, −223.5 ± 0.8, −224.0 ± 0.9, −226.5 ± 0.8 and −227.6 ± 0.8 kcal/mol. (auth)

6585

HEAT CAPACITY OF DYSPROSIUM FROM 15 TO 300°K. Maurice Griffel, R. E. Skochdopole, and F. H. Spedding (Iowa State Coll., Ames). J. Chem. Phys. 25, 75-9(1956) July.

The heat capacity of dysprosium has been measured over the range 15 to 300°K, and the thermodynamic functions have been calculated. Dysprosium had previously been found to exhibit two magnetic transitions and corresponding to these we have observed two maxima in the heat capacity, one at 174°K and a second at 83.5°K. Only the lower peak shows a dependence on the thermal history of the sample and this dependence was investigated. A correlation of the various contributions to the entropy at room temperature indicates that the magnetic contribution is R ln(2J + 1). The value of $S^0_{298.16}$ is 17.87 cal (°K)$^{-1}$ (g atom)$^{-1}$. (auth)

Refer also to abstract 6746.

SEPARATION PROCEDURES

6586 ACCO-45

American Cyanamid Co. Atomic Energy Div. Raw Materials Development Lab., Winchester, Mass.

PRECIPITATION OF RED CAKE FROM LOW VANADIUM

ACID SULFATE LEACH LIQUORS. E. T. Hollis and D. C. McLean. [1954]. 36p. Contract AT(49-1)-533. $6.30 (ph OTS); $3.00(mf OTS).

A method for producing specification grade red cake from low vanadium acid sulfate leach liquors was developed. The method consists of precipitating a high-iron red cake (60 to 70% V_2O_5, 10 to 20% Fe) from the oxidized liquor at 100°C and pH 1.5; dissolving the vanadium away from the iron by treatment with caustic, and reprecipitating the vanadium as a specification grade product in the standard manner. Indicated over-all recovery from Lukachukai leach liquors containing 4 to 5 g V_2O_5/L is 88.5%. (auth)

6587 AD-84596
Brooklyn. Polytechnic Inst.
RESEARCH ON SPECIFIC ION EXCHANGE RESINS AND THEIR USE IN THE PREPARATION OF PURE METALLIC SUBSTANCES. Final Status Report [for] Period Ending February 28, 1955. 139p. DA Project No. 599-01-004. Contract DA-30-069-ORD-980.

The titration behavior of polymeric amines (polyethyleneimine, polyvinylamine, and N-methyl polyethyleneimine) was found to be different from that of polymeric acids such as polyacrylic acid. The reaction of polyethyleneimine with several metal ions was studied potentiometrically and the order of reactivity obtained was similar to that of monomeric amines. Three moles of polyethyleneimine appeared to be bound per mole of Cu^{2+}; in the case of Ni^{2+} and Zn^{2+}, a greater number of ligands (~4) appeared to be bound per mole of metal. (auth)

6588 AERE-C/R-1520
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE SEPARATION OF ZIRCONIUM AND HAFNIUM. THIRD PHASE FORMATION IN THE SOLVENT EXTRACTION FROM AQUEOUS NITRIC ACID SOLUTIONS USING TRIBUTYL PHOSPHATE IN VARIOUS DILUENTS. E. Hudswell, J. C. H. Waldron, and B. R. Harder. Oct. 2, 1954. Decl. Jan. 22, 1956. 10p.

The regions of formation of three phases were determined when aqueous zirconyl nitrate–nitric acid solutions (10 to 100 g Zr/l and 1 to 10M HNO_3) are extracted with TBP (20 to 50 v/v %) in the diluents decalin, xylene, and carbon tetrachloride. The data thus obtained, together with the densities of the original solutions, have given a lead for further studies in the solvent extraction of zirconium. (auth)

6589 AERE-C/R-1870
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE SEPARATION OF RHODIUM-105 FROM MIXED FISSION PRODUCTS. R. B. Chenley, R. G. Osmond, and S. G. Perry. Feb. 1956. 12p.

A method is described for isolating pure Rh^{105} from mixed fission products. The procedure involves a wet oxidation, and subsequent purification of the Rh^{105} by precipitation as potassium rhodionitrite in the presence of Sb and Te hold back carriers. Other methods of purification of Rh are examined. Two spectrophotometric methods are described for the determination of Rh in the 25 to 200 μg range using the 2-mercaptobenzoxazole and SnCl complexes respectively. The 2-mercaptobenzoxazole method is more sensitive than the SnCl procedure, but the latter gives extremely reproducible results and is to be preferred. (auth)

6590 AERE-I/M-39
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE SEPARATION OF Mn^{54}, Co^{56}, Co^{58}, Zn^{65}, AND Nb^{95m} IN A CARRIER-FREE STATE BY THE USE OF ANION EXCHANGE RESIN. C. E. Mellish. Dec. 1955. 5p.

Techniques are outlined for the separation of the following isotopes from target materials using anion exchange resins in acid solution: Mn^{54} and Co^{58} from Fe, Co^{58} from Ni, Zn^{65} from Cu, and Nb^{95m} from Zr^{95}. (C.W.H.)

6591 BMI-284
Battelle Memorial Inst., Columbus, Ohio.
DESIGN CONSIDERATIONS FOR AN AMMONIUM CARBONATE LEACH PILOT PLANT. Final Report. A. R. Van Kleeck, R. D. Macdonald, and F. M. Stephens, Jr. May 15, 1956. 73p. Contract AT(49-6)-921. $0.55(OTS).

A 12-ton-per-day pilot plant was designed for extracting uranium from ores by the ammonium carbonate pressure-leach process. The design information consists of equipment specifications, equipment-fabrication drawings, process flowsheets, plant layout, and design calculations. (auth)

6592 DOW-145
Dow Chemical Co. Western Div., Pittsburg, Calif.
PROGRESS REPORT [FOR] MAY–JUNE 1956. Research Dept. R. H. Bailes. July 1, 1956. 23p. Contract AT-30-1-GEN-236. $4.80(ph OTS); $2.70(mf OTS).

Investigations of the possibility of production of high grade uranium products directly from the solvent extraction process streams, of methods for decreasing solvent entrainment in extraction of heavy slurries, and of the preparation and testing of new types of solvents are presented. (auth)

6593 DP-158
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
THERMOCHEMICAL MEASUREMENTS OF PUREX PROCESS SOLUTIONS. Glenn A. Burney. May 1956. 14p. Contract AT(07-2)-1. $0.30(OTS).

Data are presented for the specific heats of representative aqueous and organic solutions of the Purex separations process. An empirical equation, accurate within 4% of experimental values, permits the calculation of specific heats of aqueous solutions of uranyl nitrate and nitric acid throughout the ranges of process concentration. Heats of reaction are reported for the extraction of water, nitric acid, and uranyl nitrate into an organic phase composed of thirty vol.% tributyl phosphate in kerosene. (auth)

6594 ORNL-1998
Oak Ridge National Lab., Tenn.
URANIUM RAW MATERIALS PROCESS COST ESTIMATES ONE THROUGH TEN. R. H. Guymon, B. B. Klima, A. D. Ryon, W. T. Ward, and R. R. Wiethaup—K. O. Johnsson, ed. Nov. 15, 1955. 98p. Contract W-7405-eng-26. $15.30(ph OTS); $5.40(mf OTS).

Cost estimates for the recovery of U from carnotite ores by the following solvent extraction processes are outlined: Amex, Dapex, Resin-in-Pulp, Ion Exchange, and Dow Slurry. (C.W.H.)

6595 WIN-26
National Lead Co., Inc. Raw Materials Development Lab., Winchester, Mass.
THE RECOVERY OF URANIUM FROM ORE PULPS USING FIXED ION EXCHANGE RESIN BEDS. Galen W. Clevenger and James T. Lynch. Dec. 21, 1955. 25p. Contract AT(49-6)-924. $0.25(OTS).

The development of new techniques which enable an ore pulp to pass through fixed ion exchange resin beds for the recovery of dissolved values is described. Data are given for the recovery of uranium from various ore pulps in an 11-in. diameter pilot plant column. (auth)

6596 AERE-Lib/Trans-532
THEORETICAL CHEMICAL BASES OF ISOLATION OF

ELEMENTS BY EXTRACTION. V. I. Kuznetsov. Translated by V. Beak from Uspekhi Khim. 23, 654-96(1954). 58p.

The theory of solvent extraction is discussed. The mechanisms reviewed included solvent extraction based on oxonium salt formation, loss of affinity for water, and physical distribution. Numerous examples are included. (C.W.H.)

6597 AERE-Lib/Trans-699

THE SEPARATION OF TANTALUM, TITANIUM AND SODIUM AS SODIUM–LEAD ALLOYS FROM FUSED SALT MIXTURES. P. Drossbach. Translated by F. Hudswell Z. Elektrochem. 57, 548-58(1953). 24p.

A thyratron device is described with which it is possible to measure polarization potentials and single potentials down to 0.8 μ sec after switching off the current. Measurements of current yields of polarization potentials for the electrolysis of Na halides in mixtures with Na cyanide with the formation of a Na–Pb alloy and in the electrolysis of K_2TaF_7 and K_2TiF_6 in molten salt mixtures. (auth)

6598

FLOODING CHARACTERISTICS OF A PULSE EXTRACTION COLUMN. R. B. Edwards and G. H. Beyer (Iowa State Coll., Ames.). A.I.Ch.E. Journal 2, 148-52(1956) June.

An investigation using the hexone–water system was made of flooding in a 1-in.-diam. ten-plate pulse column. An analysis of column operation led to the derivation of an equation for predicting conditions of inadequate pulsation and for establishing the amount of liquid recycled under any operating conditions. (auth)

6599

PROCESS FOR FISSION-PRODUCT REMOVAL FROM URANIUM–BISMUTH REACTOR FUELS BY USE OF FUSED-SALT EXTRACTION. O. E. Dwyer (Brookhaven National Lab., Upton, N. Y.). A.I.Ch.E. Journal 2, 163-8(1956) June.

The Liquid Metal Fuel Reactor under development at the Brookhaven National Laboratory uses a fuel which is a solution of U^{233}, Mg, and Zr in liquid bismuth. For a power breeder thermal reactor, high neutron economy is essential, and this calls for low concentrations of those fission products in the fuel which are high neutron capturers. Roughly 45% by weight of the fission products can be continuously removed from the fuel by salt extraction with alkali and alkaline-earth fused-salt mixtures. These fission products contain the highly "poisonous" rare earths. A discussion of process design considerations and proposed flow sheets is presented. (auth)

6600

LIQUID-METAL EXTRACTION FOR PROCESSING OF SPENT FUEL. A. F. Voigt, A. H. Daane, E. H. Dewell, R. G. Clark, J. E. Gonser, J. F. Haefling, and K. L. Malaby (Iowa State Coll., Ames). A.I.Ch.E. Journal 2, 169-73 (1956) June.

Plutonium and the fission products can be removed from irradiated uranium by liquid-metal extraction by use of another metal immiscible with uranium. Metals studied have been silver, cerium, and lanthanum. Plutonium removal by silver is high, by the rare-earth metals moderate. In all cases volatile elements, including cesium, strontium, and barium, are removed. Rare earths are efficiently removed. Ruthenium and molybdenum are largely unaffected. Experiments with synthetic fuels corresponding to long burn-up periods show improved removal of most elements. Repeated batch extractions indicate that a continuous process separating the fuel into uranium, plutonium, and fission-product fractions could be developed. (auth)

6601

CONTINUOUS DISSOLUTION OF URANIUM–ALUMINUM REACTOR FUELS. A. F. Boeglin, J. A. Buckham, L. Chajson, R. B. Lemon, D. M. Paige, and C. E. Stoops (Phillips Petroleum Co., Idaho Falls, Idaho). A.I.Ch.E. Journal 2, 190-4(1956) June.

Extensive pilot plant studies of the continuous, mercury-catalyzed nitric acid dissolution of uranium–aluminum alloy materials similar to possible reactor fuel elements were carried out. Marked differences were observed in the dissolution rates of cast and wrought alloys. Optimum feed-acid concentrations varied with the type of alloy. At constant acid feed conditions dissolving rates varied approximately with the cube root of catalyst concentration up to a limiting concentration. The metal dissolving rate was proportional to the 0.8 power of the nitric acid feed rate. A general empirical correlation was developed. (auth)

6602

STUDIES OF THE EXTRACTION OF METAL COMPLEXES. XXXI. INVESTIGATIONS WITH SOME 5,7-DIHALOGEN DERIVATIVES OF 8-QUINOLINOL. David Dyrssen, Margareta Dyrssen, and Ebbe Johansson (Royal Inst. of Technology, Stockholm, Sweden). Acta Chem. Scand. 10, No. 3, 341-52(1956).

Equilibrium constants describing the chloroform extraction of La(III), Th(IV), and U(VI) complexes with the 5,7-dichloro, 5,7-dibromo, 5,7-diiodo and 5-chloro-7-iodo derivatives of 8-quinolinol (oxine) were investigated at 25°C. The ionic strength in the aqueous phase was kept constant at 0.1M. The overall equilibrium constant K for the extraction of metal complexes is increased by halogen substitution of the reagent. This effect, which is very pronounced for Th, is discussed in terms of the separate dissociation and distribution equilibria. The dihalogen substituted oxines are stronger acids than oxine, but the mean complexity constant, $\sqrt[N]{\kappa_N} = 10^{a}$, for the complex formation of Th (N = 4) with dichloro-oxine is about the same ($10^{9.90}$) as with oxine ($10^{9.80}$). The distribution constants of both the reagent, k_d, and of the metal complex, λ_d, are increased by halogen substitution. The molar solubilities of the dihalogen reagents in chloroform are considerably smaller (<0.06M) than the solubility of oxine (2.63M), whereas thorium dichloro-oxinate is much more soluble in chloroform (0.0135M) than is thorium oxinate (0.00088M). A favorable property of the 5,7-dihalogen derivatives is the fact that they are not extracted as oxinium ions from chloroform by moderately acidic solutions. (auth)

6603

STUDIES ON THE EXTRACTION OF METAL COMPLEXES. XXXII. N-PHENYLBENZOHYDROXAMIC ACID. David Dyrssen (Research Inst. of National Defence, Sundbyberg, Sweden). Acta Chem. Scand. 10, No. 3, 353-9(1956),

N-Phenylbenzohydroxamic acid (PBHA) was investigated at 25°C as a solvent extraction agent for La(III), Th(IV), and U(VI). Chloroform was used as the organic solvent and the ionic strength in the aqueous phase was kept constant at 0.1M by addition of $HClO_4$ and $NaClO_4$. The values of 1/N log K (where K is overall constant, and N = ionic valence) for La, Th, and U are −4.80, −0.17, and −1.57, respectively. It is shown that Th and U may easily be separated from La by batch extraction, while a good separation of Th and U would require a simple extraction column. The stoichiometric dissociation constant k_a of PBHA is $10^{-8.15 \pm 0.01}$ and its distribution constant k_d between chloroform and water is $10^{2.33 \pm 0.01}$. The mean complexity constant 10^{a} for the formation of Th tetra-N-phenylbenzohydroxamate is $10^{9.45}$ and the distribution constant λ_d of this complex between chloroform and water is $10^{3.45 \pm 0.03}$. (auth)

6604

THE SEPARATION OF ZINC FROM SOME OTHER ELE-

MENTS BY MEANS OF ANION EXCHANGE AND SOLVENT EXTRACTION, AND ITS TITRIMETRIC DETERMINATION WITH DISODIUM ETHYLENEDIA-MINETETRA-ACETATE. John A. Hunter and Christina C. Miller (Univ. of Edinbuegh). Analyst 81, 79-93(1956) Feb.

Procedures are outlined for the separation of Zn from Cd, Ga, In, and other elements and for the titrimetric determination of Zn. Zinc is separated from several other elements by adsorption on a strong-base anion-exchange resin and is eluted with dilute HNO_3. Zinc is then determined by titration with disodium ethylenediaminetetraacetate to the Solochrome black end point. No systematic errors were observed in determinations of milligram quantities of Zn. (C.W.H.)

6605

THE BEHAVIOUR OF ION-EXCHANGE RESINS WITH MIXED SOLVENTS. C. W. Davies and B. D. R. Owen. J. Chem. Soc., 1676-80(1956) June.

Data are presented for the swelling of some ion-exchange resins in acetone–water and dioxan–water, and for the distribution of the solvents between the external and resin phases. The use of partition chromatography on ion-exchange columns is illustrated by some experiments with the alkali metal cations. (auth)

6606

PROCESS ENGINEERING AT THE HANFORD SEPARATION PLANTS. Charles A. Rohrmann (Hanford Atomic Products Operation, Richland). Nucleonics 14, No. 6, 66-8(1956) June.

Plants for the separation of U, Pu, and fission products from spent reactor fuel by continuous solvent extraction processes and the problems that must be solved in remotely controlled, radioactive corrosive systems are discussed. (F.S.)

6607

THE MAGNETOCHEMISTRY OF ADSORPTION OF IONS FROM SOLUTION. C. M. French and J. P. Howard (Queen Mary Coll., London). Trans. Faraday Soc. 52, 996-8(1956) July.

The adsorption from aqueous solutions of salts of some of the Pt and Pd group of elements, and of U on silica gel was studied. Magnetic measurements on the resulting complexes indicated that the electronic configuration for the U^{3+} and U^{4+} ions is unchanged on adsorption. The electronic configuration of the adsorbed ions of the Pt and Pd groups appears to be dsp^2 or d^2sp^3. The results in these two latter groups are, however, open to alternative explanation owing to the anomalous magnetic behavior of these elements. (auth)

6608

STUDIES OF ION EXHANGER MEMBRANES. I. MEMBRANE POTENTIALS. Thorvald Smith Brun. Univ. Bergen Arbok, Naturvitenskap. Rekke, No. 15, 1954. 18p. (In English)

Cation exchanging membranes of the phenolsulfonic acid—formaldehyde type have been prepared, and exchange capacities and exchange equilibria determined. Cells for membrane potential measurements with streaming external liquids were constructed, and membrane potentials at constant concentration ratio were determined as a function of concentration for KCl and $MgCl_2$ solutions. The influence of the streaming velocity of the external liquids on the potentials was investigated. The potentials varied linearly with the square root of the mean concentration within the accuracy of measurement, and the potentials varied in inverse proportion to the square root of the streaming velocity of the external liquids, and the slope of the curve was independent of electrolyte concentration at constant concentration ratio. (auth)

6609

PAPER CHROMATOGRAPHIC SEPARATION AND QUANTITATIVE DETERMINATION OF RADIOACTIVE LABELED CONDENSED PHOSPHATE. Johannes Meissner. Z. anorg. u. allgem. Chem. 281, 293-302(1955) Dec. (In German)

Refer also to abstract 6612.

SYNTHESES

Refer to abstract 6475.

TRITIUM AND TRITIUM COMPOUNDS

Refer to abstract 6559.

URANIUM AND URANIUM COMPOUNDS

6610 AERE-C/M-265

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE REACTION BETWEEN URANIUM TRIOXIDE AND MOLTEN CAUSTIC SODA. J. R. Findlay, J. N. Gregory, and G. Weldrick. Dec. 1, 1955. 10p. (RCTC/P-59).

Investigations have been made into the composition of sodium uranate produced by the reaction of fused sodium hydroxide and uranium trioxide. A bulky red compound of composition Na_4UO_5 is first formed but on heating above 400°C it rapidly changes to a dense stable yellow compound in which the uranium to sodium ratio is in the region of 1:0.5 to 1:1.0. In determining the composition of the latter compound considerable analytical difficulties were experienced and it is not known whether the scatter of results is due to variability of composition inherent in the process of preparation or to inaccuracies in analysis. (auth)

6611 USNRDL-TR-72

Naval Radiological Defense Lab., San Francisco.

DETERMINATION OF Np^{239}, "TOTAL FISSIONS", Mo^{99}, AND Ce^{141} IN FISSION PRODUCT MIXTURES BY GAMMA-RAY SCINTILLATION SPECTROMETRY. L. D. McIsaac. Jan. 5, 1956. 18p. Project NS 081 001.

A gamma-ray scintillation spectrometric method, involving no other chemistry than sample dissolution, has been developed for the rapid determination of Np^{239} and "total fissions" in fission-product samples. A single channel NaI(Tl) scintillation spectrometer was used, and analysis required about 1 hr. The 140-kev gamma rays of Tc^{99m} and Ce^{141} were used while the 105-kev gamma ray plus conversion x ray accompanying the decay of Np^{239} was employed to measure the Np^{239} concentration. Determination of the disintegration rates of Mo^{99}, Tc^{99m}, and Ce^{141} is also possible by this technique. An accuracy of about 10% or better can be obtained. (auth)

6612

ADSORPTION OF COMPLEX ANIONS FROM URANYL SULPHATE SOLUTION BY ANION-EXCHANGE RESINS. T. V. Arden and G. A. Wood (Chemical Research Lab., Teddington and Permutit Col. Ltd., London). J. Chem. Soc., 1596-1603(1956) June.

At pH values below pH 2.5 U is adsorbed from SO_4^{2-} solution by strong-base anion-exchange resins as a complex $UO_2(SO_4)_3^{4-}$. There is evidence that adsorption occurs by the formation of this ion on the resin by the addition of UO_2SO_4 to the resin sulfate, as well as by the normal exchange process. At pH values in excess of 2.5, the U loading of the resin increases, owing to the presence of increasing proportions of $U_2O_5(SO_4)_3^{4-}$ on the resin. (auth)

6613
REDUCTION OF URANIUM WITH MAGNESIUM. H. A. Wilhelm (Ames Lab., Ames, Iowa). Metal Progr. 69, No. 3, 81-8(1956) Mar.

A detailed description of the process and equipment used in U production by Mg reduction of UF_4 is presented. (C.W.H.)

Refer also to abstract 6594.

WASTE DISPOSAL

6614 AWRE-O-42/55
Gt. Brit. Atomic Weapons Research Establishment, Aldermaston, Berks, England.
PHYSICOCHEMICAL INVESTIGATIONS INTO THE ABSORPTION AND REMOVAL OF RADIOISOTOPES FROM TEXTILES (RADIOLOGICAL DECONTAMINATION). PART I. POLYVALENT CATIONS ON COTTON. D. G. Stevenson. Nov. 7, 1955. 51p.

The effect of several variables governing the removal of representative radioisotopes from cotton has been studied and it is shown conclusively that the uptake and removal are straightforward ion exchange processes on a carboxylic material. In order to effect efficient removal under mild conditions it is necessary to use a complexing agent which will form an anionic complex with the contaminant ion. The activation energy of the process is 12 kcals and high temperatures are therefore very beneficial. Limits of decontamination are set mainly by the low diffusion rates. The general behavior is governed by mass action with respect to the solution within the fibre and this is in turn governed by Donnan membrane effects. The stability constant of the cerium-cotton complex is estimated at 3×10^5, and of the decontamination reaction with EDTA $\log^{-1} 8.16$. Diffusion constants in the more effective solutions at 25°C are of the order of 5×10^{-10} cm^2/sec. (auth)

6615
RADIOACTIVE WASTE DISPOSAL FOR THE SMALL ISOTOPE USER. Herman Cember (Univ. of Pittsburgh). Am. Ind. Hyg. Assoc. Quart. 17, 89-91(1956) Mar.

ENGINEERING

6616 NACA-RM-E52D07
Lewis Flight Propulsion Lab., Cleveland.
ANALYSIS OF STAGE MATCHING AND OFF-DESIGN PERFORMANCE OF MULTISTAGE AXIAL-FLOW COMPRESSORS. Harold B. Finger and James F. Dugan, Jr. June 27, 1952. 38p.

An analysis is presented to give a qualitative picture of the operation of each stage in a high-pressure-ratio multistage compressor over a full range of operating flows and speeds and to point out methods of improving off-design performance. Single-stage performance results have been "stacked" to form a multistage compressor in which the design or match point of each stage has been arbitrarily selected. The effects of single-stage performance, stage match point, and stator-blade-angle adjustment are considered. (auth)

6617 NP-5991
Mine Safety Applicances Co., Callery, Penna.
PROGRESS REPORT NO. 34 FOR APRIL AND MAY 1956. W. J. Posey, ed. June 11, 1956. 77p. Contract NObs-65426.

Testing of the 3 Mw steam generator and leak plugging experiments were continued. The development of liquid metal system components (High temperature pressure gage and Na-heated evaporator) was outlined. The nitriding of stainless steel, tool steel, and Be in Na with N_2 cover gas was studied. The corrosive properties, heat transfer, and stability of isopropyl biphenyl under neutron irradiation were investigated; heat transfer properties of biphenyl were also studied. (For preceding period see NP-5921.) (C.W.H.)

6618 PRL-5.17
Pennsylvania State Univ., University Park. Petroleum Refining Lab.
FLUIDS, LUBRICANTS, FUELS, AND RELATED MATERIALS. Quarterly Report No. 4 for January, February, and March 1956. Mar. 31, 1956. 95p. Contract AF33(616)-2851.

(For preceding period see PRL-5.16.)

6619 WADC-TR-56-207
Denver. Univ. Denver Research Inst.
DEVELOPMENT OF "CHAIN TYPE" POLYPHENYL COMPOUNDS FOR USE AS HIGH TEMPERATURE LUBRICANTS AND HYDRAULIC FLUIDS. [Period covered] April 15, 1955 to March 1, 1956. Josef J. E. Schmidt, John A. Krimmel, and John R. Hobaugh. Mar. 1956. 115p. Project title: RUBBER, PLASTIC AND COMPOSITE MATERIALS. Task title: SYNTHESIS AND EVALUATION OF NEW POLYMERS. Contract AF33(616)-2939.

A comprehensive literature survey on biphenyl and other "chain-type" polyphenyl compounds was conducted and abstracted data stored in a central card file and on IBM punch cards. Based on the collected data and correlations thereof a series of biphenyl and terphenyl compounds were synthesized and tested for thermal stability and other physical properties. Alkyl derivatives of biphenyl and of m-terphenyl showed considerable thermal stability. It is suggested that, among other alkyl-m-terphenyl derivatives, compounds with good thermal stability and wide liquid range may be expected. (auth)

AEROSOLS

6620
THE COLLECTION OF SUBMICRON PARTICLES BY ELECTROSTATIC PRECIPITATION. David A. Fraser (U. S. Public Health Service, Cincinnati). Am. Ind. Hyg. Assoc. Quart. 17, 75-9(1956) Mar.

Experimental data are presented which indicate that in the submicron range smaller particles are precipitated more readily than larger particles. The theory of electrostatic precipitation processes is reviewed and it is shown that the experimental data agree with theoretical predictions. A comparison is made between results obtained using the electron microscope and the optical microscope to explain the conflicting statements found in the literature. (auth)

HEAT TRANSFER AND FLUID FLOW

6621 ANL-5575
Argonne National Lab., Lemont. Ill.
INTERFACIAL AREA IN LIQUID-LIQUID DISPERSIONS RELATED TO FLUID MOTION IN MIXING VESSELS (thesis). Walton A. Rodger. June 1956. 111p. Contract W-31-109-eng-38. $1.00(OTS).

Submitted as a thesis to Illinois Inst. of Tech.

A study has been made of interfacial area in immiscible liquid-liquid systems as a function of physical properties and energy input into the system. Two methods of measuring interfacial area are presented, one photographic and

one making use of light transmittance. Data are presented for 17 O/W systems in three sizes of tanks using a variety of impeller sizes. The data are correlated empirically with an average deviation of 6.3% based on area which results in a deviation equivalent to that of the area-light transmittance correlation. While the empirical correlation does not permit of theoretical interpretation, the predicted effects of geometric and physical variables are shown to be logical. A qualitative observation of the inversion of O/W to W/O dispersions is noted and the desirability of further study of this phenomenon indicated. (auth)

6622 DGGW-EMR-55-6

Imperial Coll. of Science and Tech., London.

FLOW THROUGH POROUS MATERIALS. THE RETARDATION OF LIQUID FLOW RATES IN POROUS MATERIALS. PART II. THE EFFECT OF GASES DISSOLVED OR ENTRAINED IN THE LIQUID. P. Eisenklam. Mar. 1955. 81p. (AD-71864).

An investigation is carried out of the mechanism of reduced flow rates as experienced during film cooling and liquid filtration processes using micropored materials. Water and kerosene, and sintered steel, bronze, and glass of pore throat diameter from 13 to 47μ are used with pressure gradients up to 80 psi per inch and at room temperature. Gases in the pores by evolution from the liquid or from entrainment cause reduced but steady flow rates. The correlation between the resulting moisture content of the porous material during flow and the corresponding flow rate can be predicted for the majority of conditions examined. (auth)

6623 MF-208

National Research Council of Canada, Ottawa.

THE DESIGN OF POWER PLANT DUCTING. H. S. Fowler. May 11, 1954. 107p.

The aerodynamic design of power-plant ducting is considered, covering both pipework and the passages in cast components. The remarks apply to all gases, and qualitatively also to liquid flow. The design aim is to minimize pressure loss, to obtain uniform flow distribution, and to produce a form mechanically suited to the machinery. (auth)

6624 NACA-RM-E55L14a

Lewis Flight Propulsion Lab., Cleveland.

VISUAL STUDY OF FREE CONVECTION IN A NARROW VERTICAL ENCLOSURE. Ephraim M. Sparrow and Samuel J. Kaufman. Dec. 15, 1955. 15p.

The free-convection flow of water in a narrow vertical enclosure, cooled at the top through a copper surface and open at the bottom to a heated reservoir, has been studied by means of a shadowgraph. It was found that there is no flow pattern which is steady with time, that is, no region of the enclosure is permanently a region of upflow or of downflow. Because of variations in the size of the various upflow and downflow regions arranged along the length of the enclosure at a given time, and because of changes with time, neither upflow nor downflow regions could be characterized by a definite size. The number of upflow and downflow regions varied with time. (auth)

6625 NP-5905(Pt.1)

Massachusetts Inst. of Tech., Cambridge.

MASS TRANSFER AT LOW PRESSURES. Part I of Final Report. Thomas K. Sherwood and Norman E. Cooke. Dec. 1, 1955. 239p. OOR Project No. TB2-0001 (887). Contract DA-19-020-ORD-3244.

The rates of sublimation of naphthalene, diethyl adipate, and other esters at sub-atmospheric pressures in both stagnant and flowing systems, using air, CO_2, and He as the surrounding atmosphere, were determined. The measured effect of pressure on rate of sublimation was in good agreement with theory. (C.W.H.)

6626 NP-6018

Alfred Univ., Alfred, N. Y.

MEASUREMENTS OF THERMAL DIFFUSIVITY AND BIOT'S MODULUS FOR DENSE ALUMINA BETWEEN 1500° AND 1800°C BY AN UNSTEADY-STATE METHOD. A. E. Paladino, Jr., E. L. Swarts, J. L. Ging, and W. B. Crandall. Apr. 15, 1956. 25p. Contract Nonr-1503(02).

An unsteady-state method has been employed for measuring values of Biot's modulus and thermal diffusivity of pure dense alumina in the temperature range 1500 to 1800°C. Limits were established for possible range values of diffusivity, and corresponding values of thermal conductivity were calculated. (auth)

6627 OSR-TN-56-26

Berlin. Technische Universität.

HOT-WIRE ANEMOMETER FOR MEASUREMENTS IN UNSTEADY FLOW. O. Wehrmann and R. Wille. [1956]. 27p. Contract AF-61(514)-808. (AD-84466).

The hot-wire instrument described makes use of carrier-frequency amplification and automatic control of the constant-wire temperature. The output is linearized. Originally the instrument was designed for measuring the periodical velocity changes in the scavenging ports of a model two-stroke engine, a special case of flow research, in which great changes of the mean velocity have to be recorded correctly. An illustration of this application is given in the last part of the report. In the course of our free-jet researches the instrument is used for determining the distribution of the mean velocity. (auth)

6628 AERE-Lib/Trans-590

AN ELECTRIC METHOD OF RECORDING THE STRATIFICATION OF THE STEAM–WATER MIXTURE. A. K. Katarzhis, S. I. Kosterin, and B. I. Sheinin. Translated by J. B. Sykes from Izvest. Akad. Nauk S.S.S.R., Otdel. Tekh. Nauk, No. 2, 132-6(1955). 8p.

6629 AERE-Lib/Trans-682

THE INVLUENCE OF SURFACE TENSION AND VISCOSITY ON THE CONDITIONS OF HEAT EXCHANGE IN THE BOILING OF WATER. E. K. Averin and G. N. Kruzhilin. Translated by V. Beak from Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, No. 10, 131-7(1955). 10p.

According to experimental data on the boiling of liquid in large volume, the coefficient of heat transfer varies proportionally to the surface tension to the power −0.333, and to the viscosity of the liquid to the power −0.45, while the critical heat flux is proportional (very approximately) to the surface tension to the power 0.25 and to the viscosity of the liquid to the power −0.20. During the boiling of water in large volume under atmospheric conditions and with a horizontally or vertically placed tubular heating surface made of technological materials (steel, copper, nickelized copper), the critical flux lies within the limits 1.2×10^6 to 1.3×10^6 kcal./m^2. hour. (auth)

6630 RAE-Trans-527

SOME PROBLEMS IN THE HYDRODYNAMIC THEORY OF HEAT TRANSFER IN A STREAM OF GAS. (Nickotorye Voprosy Gidrodinamicheskoi Teorii Teploobmena Pri Techenii Gas). V. I. Ievlev. Translated by M. Goyer from Doklady Akad. Nauk S.S.S.R. 87, 21-4(1952). 7p. (AD-72452).

A method is described for calculating friction and heat transfer for bodies in a turbulent flow of gas. (D.E.B.)

6631

PURITY CONTROL IN SODIUM-COOLED REACTOR SYSTEMS. Warren H. Bruggeman (Knolls Atomic Power Lab., Schenectady, N. Y.). A.I.Ch.E. Journal 2, 153-6 (1956) June.

Recent advances in purity control in sodium systems are covered. Emphasis is placed on results from the prototype SIR system as well as other unpublished data. Included are chemical and nuclear activation analyses of sodium, filtration data, and details and operation of cold traps and plugging indicators. (auth)

6632

USE OF ZIRCONIUM IN LIQUID-SODIUM SYSTEMS. F. E. Bowman and D. D. Cubicciotti (Atomics International, Canoga Park, Calif.). A.I.Ch.E. Journal 2, 173-6(1956) June.

The attractive nuclear properties of zirconium make it a highly desirable core material for sodium-cooled reactors. The elevated temperature strength while low is sufficient for certain applications. Development of higher strength alloys is underway. Sodium in itself is completely compatible with zirconium; however, the nonmetallic contaminants, namely oxygen, hydrogen, and nitrogen, can effect serious damage. The primary problem in the use of zirconium in a sodium system, then, lies in controlling these impurities in the sodium. (auth)

6633

FLOW DISTRIBUTION AMONG PARALLEL HEATED CHANNELS. Alan R. Gruber and Seymour C. Hayman (Nuclear Development Corp. of America, White Plains, N. Y.). A.I.Ch.E. Journal 2, 199-205(1956) June.

The coolant flow distribution among parallel tubes in a nuclear reactor (or boiler or heat exchanger) can be very sensitive to variations in heat input, dimensions, etc. Analytical expressions are given for partial derivatives which measure flow variations for several situations. The utility of orifices and valves in reducing flow sensitivity is discussed. Numerical results are reported for a system using water at supercritical pressures with an eightfold expansion from inlet to outlet. (auth)

6634

HEAT TRANSFER TO WATER FLOWING PARALLEL TO A ROD BUNDLE. Philip Miller, James J. Byrnes, and David M. Benforado (Walter Kidde Nuclear Labs., Inc., Garden City, N. Y.). A.I.Ch.E. Journal 2, 226-34(1956) June.

Heat transfer was measured for water flowing parallel to $\frac{5}{8}$-in. rods in a triangular lattice (0.914-in. spacing). Velocity was varied from 5 to 20 ft./sec., temperature from 150° to 325°F., and heat flux from 50,000 to 200,000 B.t.u./(hr.)(sq. ft.). Reynolds numbers ranged from 70,000 to 700,000. Coefficients were 40% higher than predicted from the Colburn equation for flow in pipes by use of the equivalent diameter. The effect of heated length was studied. No variation in local coefficient around the rod periphery was found. Pressure drops were 65% higher than predicted by the Fanning equation (by use of D_e). (auth)

6635

A COMMON BASIS FOR THE CORRELATION OF FORCED AND NATURAL CONVECTION TO HORIZONTAL CYLINDERS. Robert Lemlich and Ronald Hoke (Univ. of Cincinnati, Ohio). A.I.Ch.E. Journal 2, 249-50(1956) June.

Natural and forced convection have always been correlated on different bases although the two phenomena have much in common. Accordingly, a method for correlating both types of convection on the same basis, at least for heat transfer outside horizontal cylinders, would be of interest. A tentative method of accomplishing this for transverse convection is presented, involving certain simplifying assumptions relating to drag and buoyancy, from which an "effective velocity" for natural convection is calculated (by means of the well-known drag correlation) and incorporated in a Reynolds number. The Nusselt number for natural convection is then correlated in terms of the Prandtl number and this Reynolds number in much the same manner as that for McAdams's well-known correlation for forced convection. For 150 different combinations of independent variables covering seven different fluids and wide ranges of diameter, surface temperature, and bulk fluid temperature, the transformed natural-convection data agree with Douglas and Churchill's recent refinement of McAdams's relationship for forced convection with an average deviation of about ±10%. (auth)

6636

ROLE OF EDDY CONDUCTIVITY IN THERMAL TRANSPORT. W. H. Corcoran and B. H. Sage (California Inst. of Tech., Pasadena). A.I.Ch.E. Journal 2, 251-8(1956) June.

Interest in the course of chemical reactions in turbulent flow has made desirable detailed knowledge of the temperature distribution in flowing streams. One method of predicting the temperature distribution under a variety of conditions is reviewed here, the approach being limited to conditions of local uniform transport of momentum. A discussion of some of the aspects of eddy conductivity is included along with a brief review of the velocity distribution in uniform flow. The results serve to illustrate the relation of microscopic conditions of flow to the temperature distribution in a turbulently flowing stream. The importance of the molecular Prandtl number upon the transfer process is stressed. (auth)

6637

ON THE OSCILLATIONS OF LAMINAR GAS FLOW. A. A. Movchan. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk, Inst. of Mechanics 20, 210-222(1956) Mar.-Apr. (In Russian)

Oscillations of a console lamina of infinite width, moving in a gas from a pinched end to the open-end at high supersonic speed has been investigated. The gas pressure was calculated by an equation of approximation. Relations between the oscillations themselves and the velocity of the laminar motion were solved by establishing the motion stability in planes. The expression for critical velocity also was determined. (R.V.J.)

6638

DESIGN HEAT EXCHANGERS MORE EXACTLY. Joseph Fabregas (Alco Products, Inc., Dunkirk, N. Y.). Chem. Eng. 63, No. 4, 181-4(1956) Apr.

Nomographs for the estimation of heat-transfer leakage correction factors (viscous and turbulent flow) in heat exchangers are presented. (C.W.H.)

6639

THERMAL RESISTANCE MEASUREMENTS AT THE CONTACT BETWEEN U AND Al SLABS. A. Ascoli and E. Germagnoli (Laboratori CISE, Milan). Energia nucleare (Milan) 3, 23-31(1956) Feb. 15. (In Italian).

Some preliminary results concerning the heat transfer between U and Al slabs are given. The dependence of the thermal resistivity of the contact upon the coupling pressure and the heat flux has been investigated in a wide range of these two parameters. (auth)

6640

ON THE STEADY FLOW PAST A SPHERE AT HIGH REYNOLDS NUMBER USING OSEEN'S APPROXIMATION. K. Stewartson (Univ. of Bristol, England). Phil. Mag. (8) 1, 345-54(1956) Apr.

The flow of a viscous fluid past a sphere at high Reynolds number as given by Oseen's approximation, in which the inertia terms of the equations of motion are linearized, is discussed. It is found that a boundary layer is formed on the forward side and a wake extending to infinity on the rearward side. Inside the wake, which is bounded by a circular cylinder with its generators parallel to the undisturbed direction of the streamlines, the fluid at infinity is moving towards the sphere, while outside it is moving

away with the undisturbed velocity, and there is a shear layer at the cylinder. (auth)

MATERIALS TESTING

6641 AD-84867
Columbia Univ., New York. School of Engineering.
SOME TESTS FOR MINIMUM LIFE OF FATIGUE FAILURE SURVIVORSHIP FUNCTIONS. Technical Report T-5A. Seiji Sugihara. Jan. 31, 1956. 17p. Contract DA-30-069-ORD-1061. (CU-5-56-ORD-1061-IE).

The statistical analysis of fatigue failure, assuming known characteristic life of machines, was made. The asymptotic theory is used based on the central limit theorem and the δ method. (F.S.)

PUMPS

6642
HYDRAULIC ANALYSIS OF SUDDEN FLOW CHANGES IN A COMPLEX PUMPING CIRCUIT. George E. Alves (E. I. du Pont de Nemours and Co., Inc., Wilmington, Del.). A.I.Ch.E. Journal 2, 143-7(1956) June.

A problem arose as to what would happen if there were sudden failures of power to one or more pumps of a large-scale complex pumping circuit composed of several individual pumping systems. The application of several published methods of hydraulic transient analysis to the problem is described. The performance of the system computed under several assumptions is discussed, and a comparison is made with experimentally determined values. (auth)

6643
ELECTROMAGNETIC PUMPS FOR LIQUID METALS. Metallurgia 53, 277-8(1956) June.

Several types of electromagnetic pumps are described for use with liquid metals of high and low density, viscosity, and resistivity. (J.E.D.)

TRACER APPLICATIONS

6644 AERE-I/R-1693
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
LEAK DETECTION IN WATER MAINS USING RADIOISOTOPES. S. Jefferson, J. F. Cameron, A. M. Wildblood, and J. L. Putman. Jan. 1956. 23p.

Leaks in water mains are divided into two classes, leaking joints in new mains and large leaks which are usually in old mains. Smaller leaks can be found by filling the main with a weak radioactive solution and looking for radioactivity in the ground near the joints. The large leaks can be traced by studying the flow of the water in the system by the movement of localized injections of radioactive solution. (auth)

VACUUM SYSTEMS

6645
HIGH VACUUM TECHNIQUE: THEORY, PRACTICE, INDUSTRIAL APPLICATIONS AND PROPERTIES OF MATERIALS. (Third Edition, Revised). J. Yarwood. New York, John Wiley and Sons Inc., 1955. 208p.

MINERALOGY, METALLURGY, AND CERAMICS

CERAMICS AND REFRACTORIES

6646 AD-50112
Armed Services Technical Information Agency Reference Center, Library of Congress, Washington, D. C.
SILICON, QUARTZ AND SILICANES: A REPORT BIBLIOGRAPHY. (312 References). Nov. 1954. 40p. (ARC-1327).

6647 NP-6024
Chicago. Univ.
THERMODYNAMICS OF THE $Zr-ZrO_2$ SYSTEM: THE DISSOCIATION ENERGIES OF ZrO AND ZrO_2. Period covered: To June 30, 1956. Technical Report No. 1 [on] THERMODYNAMICS OF REFRACTORY MATERIALS AS DETERMINED WITH A MASS SPECTROMETER. W. A. Chupka, J. Berkowitz, and Mark G. Inghram. 14p. OOR Project No. 1543. Contract DA-11-022-ORD-1993.

A mass spectrometric analysis of vapors effusing from a Knudsen cell containing either solid ZrO_2 or a mixture of Zr and ZrO_2 powders has been employed to determine the vapor pressures, and hence the heats of sublimation of these species. Combined with published thermodynamic data, these results yield 7.8 ± 0.2 ev and 14.5 ± 0.2 ev for the dissociation energies of ZrO and ZrO_2 respectively. Previous work is shown to be in error due to the volatility of TaO. (auth)

6648 NP-6025
Chicago. Univ.
POLYMERIC GASEOUS SPECIES IN THE SUBLIMATION OF MOLYBDENUM TRIOXIDE. [Period covered: To June 30, 1956. Technical Report No. 2 on THERMODYNAMICS OF REFRACTORY MATERIALS AS DETERMINED WITH A MASS SPECTROMETER]. J. Berkowitz, Mark G. Inghram, and W. A. Chupka. 17p. [OOR Project No. 1543. Contract DA-11-022-ORD-1993].

Mass spectrometric analysis of the vapor in thermodynamic equilibrium with powdered MoO_3 as sampled from a Knudsen effusion cell, has shown that the vapor phase consists predominantly of Mo_3O_9, Mo_4O_{12} and Mo_5O_{15} molecules. Utilizing the Clausius-Clapeyron equation, individual heats of sublimation have been determined to be 80.5 ± 1.5, 93.6 ± 1.6 and 105.6 ± 3.5 kcal/mole respectively at 850°K. The heats of formation and third law entropies have been evaluated for each of these molecules. (auth)

6649 WADC-TR-52-106
Metallurgical Research and Development Co., Inc., Washington, D. C. and S-K-C Research Associates, Patterson, N. J.
PRODUCTION OF CERMETS BY FLASH SINTERING PROCESS. Summary Report [from] October 1, 1950 through March 31, 1952. M. Hill, M. W. Taylor, G. S. Mikhalapov, E. G. Touceda, C. L. Clark, W. V. Knopp, and J. D. Shaw. Apr. 1952. 69p. Contract AF33[038]-16032. (AD-6459).

The historical background of the flash sintering process, a description of the equipment, and test results are presented. The most favorable conditions of power input, time and pressure required to produce a nickel–titanium carbide compact of optimum physical characteristics were determined. Evaluation of sintered compacts was made by determination of density, hardness, modulus of rupture and optical analysis. Recommendations for further work on this process are made. (auth)

6650 WADC-TR-52-111

Illinois. Univ., Urbana.

METAL BONDED TITANIUM DIBORIDE. James A. Nelson, Tracy A. Willmore, and Dwight G. Bennett. Mar. 1952. 36p. Contract W-33(038)-ac-14520. (ATI-158806).

Titanium diboride in a finely divided state was combined with 30 wt. % of either powdered iron, cobalt, nickel, chromium, or zirconium and pressed into compacts which were fired in an argon atmosphere at temperatures exceeding the melting point of the added metal. The sintering characteristics of the compacts and the phases present after firing are described. Tests were made for oxidation resistance at 2000°F. The information obtained from this investigation is discussed with a view towards further work regarding the possibilities of using metal bonded titanium diboride in high-temperature applications for flight propulsion units. (auth)

6651 WADC-TR-52-155

New Jersey. Ceramic Research Station, New Brunswick.

TITANIUM NITRIDE CERMETS. Frederick K. Davey, Ernest R. Glabau, and G. Edwin Lorey. July 1952. 33p. Contract W-33-038-ac-15800. (ATI-174445).

Several compositions of cermets based on titanium nitride were investigated. The cermets were tested for strength in cross bending, resistance to oxidation, and resistance to thermal shock. The differences of the various compositions are noted as well as the effect of different processing techniques. Titanium nitride cermets containing chromium as the metal phase were found to have the best properties of the compositions investigated. (auth)

6652 WADC-TR-54-173(Pt.1)

Ohio State Univ. Research Foundation, Columbus.

ALUMINA-BASE CERMETS. [Summary Report for] March 1, 1953 to March 1, 1954. Thomas S. Shevlin and Charles A. Hauck. Mar. 1954. 51p. Contract AF33(616)-472. (AD-49092).

Preparation, test procedure, and physical properties of a cermet composed of 34% Al_2O_3–66% (80Cr–20Mo), in addition to modified compositions, are described. Properties evaluated include firing shrinkage, density, modulus of rupture, tensile strength, stress-rupture, modulus of elasticity, oxidation resistance, thermal shock resistance, and hardness. X-ray studies were conducted to determine solid solution effects. The cermet studied had a 1000-hour stress-rupture life at 1800°F of 19,000 psi, negligible oxidation to 2000°F and excellent thermal shock resistance at 1900°F. This material is being evaluated for nozzle vane and flame holder applications. (auth)

6653 WADC-TR-54-467

Pennsylvania State Univ., University Park. [Coll. of Mineral Industries].

REFRACTORY MATERIALS FOR USE IN HIGH TEMPERATURE AREAS OF AIRCRAFT. [Period covered] June 16, 1952 to January 1, 1956. Norman R. Thielke. July 1955. 96p. Project title: CERAMIC AND CERMET MATERIALS. Task title: CERAMIC AND CERMET MATERIALS DEVELOPMENT. Contract AF33(616)-139.

The fracture patterns of TiC–cermet stator blades which had been exposed to a simulated service test and the microstructures of these materials were investigated. The oxidation behavior of cermets was studied theoretically, and experimentally. Theoretically, the tendency to oxidize was derived from an oxidation free energy plot for the reactions representing the complete oxidation of Ti-, Nb-, Ta-, Si-, Fe-, Co-, Ni- and Cr-carbides. Experimentally the oxidation behavior of carbide and metal powders was investigated using the differential thermal analysis technique. The oxidation resistance of carbide powders increased approximately in the following order: VC, TiC, NbC, B_4C, WC, ZrC, TaC, Cr_xC_y, SiC. A similar classification has been found for metal powders with Cr and Si ranking best. The ternary system TiC–TaC–NbC has been investigated, using sintering temperatures up to 2530°C. The reactions were almost complete, indicating a complete solid solution throughout the system. Of all the sintered compositions in this system, TiC exhibited the greatest oxidation resistance. The sintering and shrinking behavior of oxide mixtures simulating the oxides which are being formed during the oxidation of carbide cermets, has been studied in search for compositions which form a dense and adherent oxide film. Aluminum titanate bodies with additions of alumina, manganese carbonate and cesium Pyrex glass showed a modest increase in strength which was offset by an increase in thermal expansion. An analysis of the applicability of thermal shock tests has been made. A static method to measure the two thermal stress resistance factors R and R′ is described and measurements on porous and dense titania, steatite, cordierite and β-spodumene bodies are presented. (auth)

6654

CERAMICS—VERSATILE NUCLEAR MATERIALS. Nucleonics 14, No. 6, 64-5(1956) June.

Ceramics offer more long-range promise than metals for higher thermal efficiencies in reactor design for cheaper nuclear power. Ceramics have found use as refractory material for melting and casting nuclear fuel and as a medium for permanent waste disposal. (F.S.)

6655

HIGH-TEMPERATURE STABILITY OF INSULATING AND REFRACTORY CASTABLES IN REDUCING AND OXIDIZING ATMOSPHERES. C. M. Vogrin and H. Heep (M. W. Kellogg Co., New York). Trans. Am. Soc. Mech. Engrs. 78, 1021-9 (1956) July.

A review of the test program of an investigation of the possible application of castable linings for services involving temperatures to 2400°F in reducing atmospheres of CO, H_2, CO_2, CH_4, and H_2O is given. (F.S.)

6656

EFFECTS OF POLARIZATION ON THE PIEZOELECTRIC PROPERTIES OF BARIUM TITANATES. S. V. Bogdanov, B. M. Vul, and R. Ya. Razbash. Zhur. Tekh. Fiz. 26, 958-62(1956) May. (In Russian)

Investigations are made of the effects of electric field intensity and temperature, in polarization of polycrystal specimens of barium titanates, on their piezoelectric modulus d_{33}. It has been shown that at an increased temperature range, it is possible to carry out polarization with reduced field intensities. (tr-auth)

Refer also to abstract 6626.

CORROSION

6657 AERE-M/TN-35

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

INHIBITION OF LIQUID-METAL CORROSION. J. W. Taylor. Feb. 10, 1956. 9p. (MSWP-N/18).

From a consideration of the common mechanisms of liquid metal corrosion, additions to liquid metals which inhibit corrosion are classified as scavenging or diffusion-barrier types. Desirable characteristics of both classes of inhibitor are discussed and possible limitations to the zirconium nitride inhibitor, proposed for liquid metal fuelled systems based on bismuth, are considered. Sug-

gestions are made for overcoming such limitations and it is recommended that surface layers of the metals molybdenum, tantalum, niobium and possibly beryllium be tested as alternative inhibitors of the diffusion-barrier type. (auth)

6658 BNL-395

Brookhaven National Lab., Upton, N. Y.

STATIC CORROSION BEHAVIOR OF MATERIALS IN BISMUTH AND URANIUM–BISMUTH SOLUTION AT 550°C. J. E. Atnerton, O. F. Kammerer, C. J. Klamut, and J. Sadofsky. Aug. 1954. 10p. (LMFR-9). $0.15(OTS).

It has been shown that the intermediate Cr steels corrode in Bi or U–Bi solutions. The addition of small amounts of Mg and Zr to the Bi makes this corrosion negligible. A Zr nitride layer has been identified on the surface of inhibited static samples. (auth)

6659 AEC-tr-2490

ON PROTECTIVE FILMS OF OXIDE AND HYDROXIDE ON MAGNESIUM. N. K. Shishakov. Translated from Zhur. Fiz. Khim. 26, 357-63(1952). 10p.

Investigations show that natural protective oxide film on the surface of Mg has the structure of ordinary MgO. Action of alkaline solutions of oxidizing agent at room temperature formed on the surface an ordinary structure of $Mg(OH)_2$. Treatment of Mg with hot solutions, boiling water, etc. formed on the surface a new structure, apparently also a hydroxide. Tests of Mg with atmospheric corrosion showed that the most inert specimens have on their surface precisely this new hydroxide of unknown structure. (auth)

6660

APPARATUS FOR VISUAL STUDY OF CORROSION BY HOT WATER. Daniel R. Grieser and Eugene M. Simons (Battelle Memorial Inst., Columbus, Ohio). A.I.Ch.E. Journal 2, 215-18(1956) June.

The design and operation of a windowed autoclave suitable for studying corrosion of materials by pressurized hot water are described. The technique for taking time-lapse motion pictures of a specimen from the instant of contact with the high-temperature water until the corrosion is complete is explained, and a set of typical pictures is presented showing the progress of the attack. Pressure and temperature measurements provide a means for rough computation of corrosion rates, as is shown by the results of two tests of uranium specimens subjected to pressurized hot water. (auth)

6661

CORROSION TESTING AT HIGH TEMPERATURES. N. D. Greene, Jr. (Ohio State Univ., Columbus). Chem. Eng. 63, No. 4, 175-80(1956) Apr.

Important factors in the study of high-temperature corrosion include container specifications, temperature measurement and control, length of experiment, and safety considerations. The methods of corrosion testing and applications of test results are discussed. (C.W.H.)

6662

CORROSION TESTING OF ALUMINUM. PART 2. DEVELOPMENT OF A CORROSION INHIBITOR. Sumner B. Twiss and Jack D. Guttenplan (Chrysler Corp., Detroit). Corrosion 12, 311t-16t(1956) July.

An accelerated corrosion test was used to test a number of corrosion inhibitors at different concentrations to determine their effectiveness in preventing corrosion of No. 100 aluminum brazing sheet in Royal Oak tap water. Four inhibitors were found to be effective under conditions of static test, 1000 rpm and 12,000 rpm. These inhibitors were: soluble oil with or without trisodium phosphate, sodium dichromate, sodium silicate, and disodium hydrogen phosphate. Of these, all but the soluble oil are either noncompatible or might lose their effectiveness when used in standard antifreeze solutions. The corrosion inhibition of clad aluminum by soluble oil is less effective in waters of combined high pH and high chloride ion than it is in waters of high chloride alone. Addition of a buffer to the soluble oil to maintain the solution pH near 7.0 improves the effectiveness of this inhibitor in high pH solutions. The combination of soluble oil and buffer satisfactorily inhibits the corrosion of clad aluminum in 1:1 ratio ethylene glycol-water (pH 11) and isopropyl alcohol-water (pH 11) solutions, typical of the worst radiator solutions that might be encountered. The inhibition is somewhat less effective when the clad aluminum is coupled with brass. (auth)

6663

FUNDAMENTALS OF LIQUID METAL CORROSION. W. D. Manly (Oak Ridge National Lab., Tenn.). Corrosion 12, 336t-42t(1956) July.

The corrosion of structural metals in liquid metals is for the most part the result of solubility of the various constituents of the metal or alloy in the liquid metal. The manner in which this solution manifests itself gives rise to many types of attack, ranging from a simple solution type attack to a deep intergranular attack with the preferential leaching of one constituent of an alloy. Examples of the many types of corrosion experienced with solid metal-liquid metal systems are illustrated. The role of impurities on the corrosion is discussed. In addition to the solution stage, which would soon disappear in a static one metal system on reaching a solubility limit, the corrosion of metals can be continued through the removal of materials from solution in the liquid metal with a temperature gradient or by dissimilar metal transfer. The transfer of metal in a plumbing system by the mechanisms of mass transfer—temperature gradient and dissimilar—will greatly increase the amount of corrosion as compared to the results obtained in static systems. Examples of temperature gradient mass transfer and dissimilar metal transfer are reviewed, and factors governing the occurrence of these phenomena are outlined. (auth)

6664

PITTING CORROSION OF 18Cr–8Ni STAINLESS STEEL. M. A. Streicher (E. I. du Pont de Nemours and Co., Inc., Wilmington, Del.). J. Electrochem. Soc. 103, 375-90(1956) July.

Factors controlling pitting corrosion and laboratory methods used for its study are reviewed. An electrolytically accelerated test was developed for investigation of pit initiation. A controlled direct current was passed through a cell whose anode was the stainless steel specimen and whose electrolyte was the pitting solution. The number of pits formed depended on the current density, the steel specimen (composition and surface treatment), and the solution (composition and temperature). The accelerated electrolytic pitting method was used to determine the influence of alloying elements added to 18Cr–8Ni stainless steel on pit initiation in sodium chloride and bromide solutions. Reduction in carbon content, increase in nitrogen content of these steels, and alloying additions of molybdenum and silicon increased resistance to pit initiation. Grain boundaries, rather than nonmetallic inclusions, were primary sites of pit initiation during simple immersion or in the electrolytically accelerated test. (auth)

6665

PREDICTING CORROSION RESISTANCE BY MICROSCOPIC EXAMINATION. John H. Scott (Lukens Steel Co., Coatesville, Penna.) Metal Progr. 69, No. 3, 79-80, 80B(1956) Mar.

Stainless steel plates which must pass a 240-hr HNO_3 corrosion test can be released for shipmen while the test is in progress by use of a quick microscopic screening method. (auth)

GEOLOGY AND MINERALOGY

6666 NYO-6674

Pennsylvania State Univ., University Park. Mineral Industries Experiment Station.

AN INVESTIGATION OF THE CHEMICAL NATURE OF THE ORGANIC MATTER OF URANIFEROUS SHALES. Period covered: October 1, 1955 to March 31, 1956. C. R. Kinney, J. T. Leonard, T. J. Roessing, and F. J. Vastola. Mar. 31, 1956. 11p. Contract AT(30-1)-1442. $3.30(ph OTS); $2.40(mf OTS).

Work on the separation of ether-soluble ozonization products of the shale into water-soluble and water-insoluble fractions is outlined. The results of extraction of mineral matter of one kilogram of minus 200 mesh shale with dilute HNO_3 and hot HCl, the thermal decomposition or pyrolysis of the structure and composition of complex organic materials are discussed. (J.E.D.)

6667 TEM-929

Geological Survey.

A RECONNAISSANCE FOR URANIUM IN PARTS OF NEW MEXICO AND COLORADO, 1954. Elmer H. Baltz, Jr. June 1955. 44p. $0.30(OTS).

Reconnaissance investigations for uranium in parts of New Mex. and Colo. were undertaken with portable Geiger counters and scintillators and with carborne scintillation equipment. Samples of copper-bearing arkosic sandstone of the Cutler formation collected in the northwestern part of the Jemez Plateau, Rio Arriba Co., N. Mex. contain 0.002 to 0.10% uranium. The Bandelier tuff of Pleistocene age contains traces of radioactive material throughout much of this region. Samples of intrusive and extrusive igneous rocks of Tertiary and Quaternary ages from the Chico Hills, eastern Colfax Co., N. Mex., contain 0.0016 to 0.0024% uranium. Radioactivity was detected in igneous rocks of intermediate composition at all localities examined, but no radioactivity was detected in basic igneous rocks or in sedimentary rocks which enclose the intrusives. Precambrian, Pennsylvanian, Permian, and Tertiary rocks were examined at places in the Sangre de Cristo Mountains, northern New Mexico. Samples of carbonaceous sandstone and conglomerate of the Chinle formation of Triassic age collected south of the Canadian Escarpment, San Miguel Co., N. Mex., contain 0.004 to 0.070% uranium. Several prospects near the town of Sabinoso contain uranium deposits of possible economic value. Extent of these deposits has not been determined. No significant radioactivity was detected in Permian, Cretaceous and Quaternary sedimentary rocks and Tertiary intrusive rocks examined at places in Lincoln and Otero Co., N. Mex. Radioactivity estimated to be 0.008% equivalent uranium was detected in limestone of the Wanakah formation of Jurassic age near Cuchara Camps, Huerfano Co., Colo. A sample of acidic tuff of the Devil's Hole formation of Miocene (?) age collected in northern Huerfano County contains 0.0011 % uranium. (auth)

6668

THE APPLICATION OF THE α-HELIUM METHOD TO SOME ARCHAEAN SPECIMENS. V. S. Venkatasubramanian and V. S. Aithal (Indian Inst. of Sci., Bangalore). J. Sci. Ind. Research (India) 15B, 3-5(1956) Jan.

6669

PHOTOGEOLOGIC MAP OF THE FREDONIA NW QUADRANGLE, MOHAVE COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-133. W. R. Hemphill. Washington, U. S. Geological Survey, 1956. $0.50.

6670

PHOTOGEOLOGIC MAP OF THE KAIPAROWITS PEAK-1 QUADRANGLE, GARFIELD COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-134. J. S. Detterman. Washington, U. S. Geological Survey, 1956. $0.50.

6671

PHOTOGEOLOGIC MAP OF THE KAIPAROWITS PEAK-7 QUADRANGLE, GARFIELD COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-136. J. S. Detterman. Washington, U. S. Geological Survey, 1956. $0.50.

6672

PHOTOGEOLOGIC MAP OF THE KANAB SE QUADRANGLE, KANE COUNTY, UTAH, MOHAVE AND COCONINO COUNTIES, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-137. J. S. Detterman. Washington, U. S. Geological Survey, 1956. $0.50.

6673

PHOTOGEOLOGIC MAP OF THE SHINARUMP NW QUADRANGLE, COCONINO COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-139. R. H. Morris. Washington, U. S. Geological Survey, 1956. $0.50.

6674

PHOTOGEOLOGIC MAP OF THE SHORT CREED SW QUADRANGLE, MOHAVE COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-140. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

6675

PHOTOGEOLOGIC MAP OF THE HEATON KNOLLS NW QUADRANGLE, MOHAVE COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-143. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

6676

PHOTOGEOLOGIC MAP OF THE LOST SPRING MOUNTAIN SE QUARDRANGLE, MOHAVE COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-144. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

6677

PHOTOGEOLOGIC MAP OF THE LOST SPRING MOUNTAIN NE QUADRANGLE, MOHAVE COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-145. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

6678

PHOTOGEOLOGIC MAP OF THE LOST SPRING MOUNTAIN NW QUADRANGLE, MOHAVE COUNTY, ARIZONA. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-146. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

6679

PHOTOGEOLOGIC MAP OF THE VIRGIN SW QUADRANGLE, WASHINGTON COUNTY, UTAH. MISCELLANEOUS GEOLOGIC INVESTIGATIONS MAP I-147. C. H. Marshall. Washington, U. S. Geological Survey, 1956. $0.50.

6680

AN APPLICATION OF SPECTROGRAPHIC MICROPHOTOMETRIC SCANNING. C. L. Waring, Mona Franck and A. M. Sherwood. U. S. Geol. Survey Bull. 1036-E, 1956. 12p. $0.15(GPO)

A previously published semiquantitative spectrographic method was modified by applying microphotometric scanning of the spectrograms in such a way that the operator was free to do other work during a large part of the scanning time. The spectrograms of 5 ash samples from Dakota lignite and one synthetic mixture were scanned for 68 ele-

ments; 32 elements were found and those below 10% were reported quantitatively. The tests included a spectrum-line study to provide lines least enhanced or depressed by matrix differences, information on accuracy, on human error, and eye fatigue. In 93% of the cases the agreement with the chemical analysis was within a factor-of-10 bracket, ket, 85% were within a factor-of-5 bracket, and 79% were within a factor-of-2 bracket. (auth)

6681

ON THE GEOLOGICAL DETERMINATION OF AGE BY THE POTASSIUM–ARGON METHOD. W. Gentner and W. Kley (Univ. of Freiburg, Germany). Z. Naturforsch. 10a, 832-3 (1955) Nov. (In German)

METALS AND METALLURGY

6682 AD-35954

Case Inst. of Tech., Cleveland.

OVERCOMING RHEOTROPIC EMBRITTLEMENT IN TITANIUM AND TITANIUM BASE ALLOYS. Quarterly Report No. 3 [for] February 15, 1954 to May 15, 1954. E. J. Ripling. June 4, 1954. 29p. Project No. 54-670A-61. Contract AF33(616)-2223.

A preliminary investigation of rheotropic effects in titanium suggested that a rheotropic recovery was possible in this material only when the content of the interstitial elements (carbon in this case) was not excessively high. An investigation of the effect of composition on the ability of cold work to improve the ductility and toughness of these alloys was initiated. Two series of binary alloys, one with manganese additions up to 8.0% and the other with nitrogen additions up to 0.3% were to be the basic materials for this study. One commercial alloy (Ti 140A) and one experimental alloy (Ti–3Mn-Complex) are also being investigated on the project. Since the molybdenum base and the chromium base alloys are also non-face-centered-cubic, some short studies of the rheotropic behavior of these alloys are also being conducted. (auth)

6683 AD-46550

Louisville, Ky. Univ. Inst. of Industrial Research.

A BIBLIOGRAPHY OF SELECTED BORIDES, NITRIDES, AND PHOSPHIDES. T. R. Bailey, Henry James, and LeRoy A. Peterson. [1949]. 15p. Contract N8onr-80200.

6684 AD-49140

Ryan Aeronautical Co., Lindbergh Field, San Diego, Calif.

INVESTIGATION OF FORMABILITY AND WELDING CHARACTERISTICS OF COMMERCIALLY-PURE TITANIUM SHEET MATERIAL. Final Report. J. T. Simmons, R. E. Williams, and D. S. Adams. Sept. 15, 1954. 225p. Contract AF 33(600)-22169. (G-17-65).

Three grades of commercially pure Ti sheet (Ti-75A, RC-70, and RS-70) were investigated to evaluate their formability and welding characteristics. Forming operations were accomplished without heat with the appropriate lubricants. In drop-hammer forming, heated dies were impractical. Good forming was obtained with the use of heated blanks, SAE 250 lubricant, forming rubber, a steel-jacketed lead punch, and a Kirksite die. Bend tests were a more valid index of the formability of Ti than the criteria such as hardness, yield strength, ultimate tensile strength, and elongation. The bend ductility of the 3 Ti specimens was greater when the axis of bend was transversed to the direction of rolling. In hydropress forming, colloidal graphite was the most practical lubricant for use in hot or cold forming. Fusion welding was performed successfully with argon, and welding schedules were established for Heliarc and resistance welding. Except for pickling, the best cleaning methods were the same as those used for stainless steel. Satisfactory riveting and dimpling were accomplished by hot (600 to 656°F) forming. A partial anneal obtained by subjecting the part to a temperature ranging from 1200 to 1300°F for 10 min was sufficient for the removal of stress resulting from work-hardening. It was concluded that Ti can be formed and fabricated with the use of heat and other techniques. (auth)

6685 AD-51073

American Electro Metal Corp., Yonkers, N. Y.

INVESTIGATION OF THE EFFECT OF RAW MATERIAL PRODUCTION VARIABLES ON THE PHYSICAL AND CHEMICAL PROPERTIES OF CARBIDES, NITRIDES AND BORIDES. Final Report. H. Blumenthal. Dec. 1954. 135p. Contract AF33(616)-89.

Studies of TiC powders indicated that particle size reduction by ball milling is independent of the ball-milling medium and is a function of ball milling time, size and kind of the ball mill, and ball-to-load ratio. Procedures are presented for the determination of particle size distribution of a fine powder and for a flotation of such a material, which removes free carbon. Titanium carbide powders without binder addition were not pressed to high densities and tested for electrical resistivity and corrosion resistance. Densification was favorably influenced by decrease in particle size, addition of up to 1% of free carbon, and acid leaching. Leaching of a ball milled powder before hot pressing or higher densities of the hot pressed bars decreased electrical resistivity. Titanium oxide was the only corrosion product found when TiC or TiC/WC 90/10 bars were exposed to air at 1000°C. The factors governing infiltrability were studied when pieces of low densities were infiltrated with liquid Co and Ni. Results indicated that an oxide film surrounding the individual carbide particles was beneficial for good infiltration. Nickel bonded dense TiC bars were produced by hot or cold pressing of ball milled powders followed by vacuum sintering. Various factors determining densification and transverse rupture strength, such as the presence of O_2, C, Fe, and other carbides as well as ball milling, pressing, and sintering procedures were investigated. Results suggested that the relationship of these factors to the physical properties of final bars changed considerably with the TIC origin. Microstructure, grain shape, and grain growth were shown to be functions of three interrelated factors: production procedure of the TiC, surface conditioning of the particles and impurities in the powder. (auth)

6686 AD-54006

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

CASTING OF TITANIUM AND TITANIUM BASE ALLOYS. Final Report [for November 19, 1952–March 31, 1954]. Marvin Glassenberg and Lyle L. Clark. 35p. ARF Project No. B-046. Contract NObs-61229.

The development of techniques for producing titanium and titanium base alloy castings was studied. An induction furnace was used for melting the titanium in a graphite crucible. Over 240 heats have been made in this furnace. Various mold materials have been evaluated for the casting of titanium. Zircon shell molds coated with a heavy layer of colloidal graphite have been found to give castings with a fine surface finish. Several castings of industrial significance have been successfully made with this type of mold. These include gate valve bodies and discs, globe valve bodies, and 90° elbows. A major source of difficulty in producing sound castings was the entrapment of the mold atmosphere (mostly argon) by the incoming metal and gases formed by thermal decomposition of the mold binder blowing into the cavity or casting. This caused formation of gas pockets within the casting during solidification. The

amount of entrapped gases in the casting was reduced by various gating, venting, and purging techniques, but were not entirely eliminated. Titanium–2% iron and titanium–1.2% iron–0.8% vanadium alloys have been found to have good casting characteristics. However, due to impurity pick-up the ductility of cast specimens made with these alloys has been found to be negligible. The tensile strength varied in the as-cast and heat-treated condition between approximately 80,000 and 130,000 psi. An arc furnace for melting 100 lb of titanium has been designed and fabricated. Techniques for intermittent tapping a charge of titanium from a furnace have been investigated. Only preliminary heats have been conducted in the arc furnace and no actual castings have been made. (auth)

6687 AD-70656

Rensselaer Polytechnic Inst., Troy, N. Y. Powder Metallurgy Lab.

ALUMINUM POWDER METALLURGY. Progress Report No. 10 for April 1, 1955 to June 30, 1955. F. V. Lenel, E. C. Nelson, M. V. Rose, and G. S. Ansell. July 27, 1955. 42p. Project 52-670A-270. Contract AF33(616)-351.

X-ray-diffraction patterns of cold-worked and annealed extrusions of aluminum powder indicated the growth of large grains. An etching technique was developed to reveal these grains. Specific surfaces were determined by the gas adsorption method for four grades of flake powder. Comparison of the results with specific surfaces obtained from covering capacity measurements indicates that the surfaces of the flakes are irregular and cracked from the milling process. A successful technique was developed for producing electron micrographs of sintered aluminum powders. A lineal analysis of oxide particles shown in these micrographs correlates well with the known oxide contents. (auth)

6688 AECU-3264

Illinois. Univ., Urbana.

DIFFUSION IN METALS—PROGRESS REPORT AND PUBLICATION LIST. Frederick Seitz and David Lazarus. June 15, 1956. 11p. Project No. 3. Contract AT(11-1)-67. $3.30(ph); $2.40(mf).

Studies are made on self-diffusion in Au and Ag, and Au^{198} and Ag^{110} diffusion in pure Cu crystals. Diffusivities of Fe^{59}, Co^{60}, Ni^{63}, and Mn^{54} tracers in Cu have been measured as a function of temperature over the range of 700 to 1075°C. All specimens were analyzed by lathe-sectioning and counting. Preliminary measurements of diffusion in binary alloy AgZn, AgCd, and AgIn are tabulated. The diffusion of Cu^{64}, Zn^{65}, and Sb^{124} in β brass at 265 to 817°C, and the internal friction and diffusion in 31% α brass in temperature range of 175 to 575°C are measured. (R.V.J.)

6689 AF-TR-6517(Pt.3)

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

DETERMINATION OF PHYSICAL PROPERTIES OF FERROUS AND NONFERROUS STRUCTURAL SHEET MATERIALS AT ELEVATED TEMPERATURES. PART 3. Donald E. Miller. June 1954. 222p. Contract AF-33(038)-8681. (AD-42722).

In order to establish important design criteria, tensile, compressive, bearing, and shear properties have been determined for the following materials and conditions: 14S-T6 aluminum alloy sheet (clad) at room temperature and at elevated temperatures ranging from 200 to 600°F, for exposure periods between 0.5 and 1000 hr; 24S-T81 and 24S-T86 aluminum alloy sheet (clad) at room temperature and at 200, 300, and 400°F for exposure periods between 0.5 and 1000 hr; FS1-H24 magnesium alloy sheet at 200°F, for exposure periods of 0.5 and 1000 hr; 75S-T6 aluminum alloy sheet (clad) at 200°F, for exposure periods between 0.5 and 1000 hr; cold rolled titanium and annealed titanium at 200°F, for exposure periods of 0.5 and 1000 hr; and RC-130-A titanium alloy at room temperature and at temperatures ranging from 300 to 800°F, for exposure periods of 0.5, 100, and 1000 hr. A comparison was made between the tensile data and the data on other properties in an attempt to formulate a method for estimating all other elevated temperature properties from a knowledge of tensile elevated temperature properties and room temperature values of other properties. The conclusion was reached that the various properties are not related in a simple, consistent manner. Test specimens, equipment, and procedures are described in detail. Test results are presented in the form of tables and curves to illustrate the effect of temperature and exposure time on the mechanical properties of the various materials under investigation. (auth)

6690 APEX-244

General Electric Co. Aircraft Nuclear Propulsion Dept., Cincinnati.

SOME THERMAL PROPERTIES OF SOLID MATERIALS. PART I. METALS. M. E. Lapides and R. C. Brubaker. Sept. 9, 1955. 65p. (XDC-55-10-10). $0.40(OTS).

This report presents a review of the theoretical background of some thermal properties of metals and the results of a literature search for experimental data concerning various physical properties. Data are presented for thermal conductivity, specific heat, density, emissivity, melting points and thermal expansion coefficients, with emphasis on the first two of these items. Metals considered include Al, Be, Inconel X, Fe and steel, Pb, Mo, Nb, and U. (auth)

6691 BMI-1097

Battelle Memorial Inst., Columbus, Ohio.

ELECTROCLADDING OF ZIRCONIUM WITH PLATINUM. Arch B. Tripler, Jr., John G. Beach, and Charles L. Faust. June 21, 1956. 12p. Contract W-7405-eng-92. $0.20(OTS).

A method, which included the use of periodic reverse plating, was developed for electrocladding Zr with sound, porefree Pt coatings up to 1.5 mils in thickness. The method was used to electroclad Zr specimens with 0.5 to 0.75 mil of Pt for in-pile corrosion tests at ORNL. The in-pile tests were not completed at the time this report was prepared. (auth)

6692 BMI-1100

Battelle Memorial Inst., Columbus, Ohio.

A FUNDAMENTAL INVESTIGATION OF HYDROGEN EMBRITTLEMENT IN ZIRCONIUM. Arthur P. Young and Charles M. Schwartz. June 27, 1956. 24p. Contract W-7405-eng-92. $0.25(OTS).

Investigations were made to determine the relationship between the microstructure and the low impact strength of hydrogenated Zr. Unnotched tensile samples of degassed Zr and of hydrogenated Zr deformed either slowly or at impact velocity were analyzed with light and electron microscopes to determine the relationship between microcracks and microstructures. Only few microcracks were observed at the grain boundaries of degassed Zr while in hydrogenated Zr, microcracks were more numerous particularly in tensile-impact samples, obviously, formed by parting at interfaces between hydride platelets and Zr. This may be related to higher incidence of deformation twinning in impact samples. Hydrogen embrittlement in Zr is, apparently, due to microcrack formation at hydride-Zr interfaces. Investigations showed some evidence that hydrogen embrittlement decreases with decreasing grain size and is abnormally enhanced by slow prestrain before impact. (auth)

6693 CAL-KB-914-M-5
Cornell Aeronautical Lab., Inc., Buffalo.
RELAXATION BEHAVIOR OF TITANIUM AND TITANIUM ALLOYS. Quarterly Progress Report. F. J. Gillis. Nov. 15, 1955. 19p. Contract AF33(616)-2340.

Data are tabulated for relaxation behavior of commercially pure A-70 Ti and C-130 AM Ti alloy at room temperature, 600, and 800°F. Relaxation tests for A-70 Ti were made in two microstructural conditions (fine and coarse). Photomicrographs are given for the C-130 AM and A-110 AT alloy structures selected for the tests. (R.V.J.)

6694 EES-040029I
Naval Engineering Experiment Station, Annapolis.
PROPERTIES OF HASTELLOY R ALLOY AT 1350° AND 1500°F TEMPERATURES. W. Lee Williams. Jan. 25, 1955. 14p. (AD-56665).

Two lots of Hastelloy R alloy, one lot vacuum melted and the other apparently melted by conventional techniques, were tested in room temperature tension and in tension, creep and rupture at 1350 and 1500°F. The strength properties were good from the standpoint of high strength combined with a minimum use of critical materials. The vacuum melted material was stronger and had better ductility. (auth)

6695 EMRL-4
Brown Univ., Providence. Engineering Materials Research Lab.
THEORY FOR COMBINED BENDING AND TORSION FATIGUE WITH DATA FOR SAE 4340 STEEL. Technical Report No. 1 on BASIC RESEARCH ON FATUGIE FAILURES UNDER COMBINED STRESS. W. N. Findley, J. J. Coleman, and B. C. Hanley. Apr. 1956. 33p. Project 7B2-0001-(1348). Contract DA-19-020-ORD-3520.

Fatigue under combined bending and torsion is experimentally investigated and analyzed for SAE 4340 steel at a hardness of Rockwell C-25 and for completely reversed cycles. For each state of combined stress the stress S versus cycle N relations are shown to be expressible by the relation $S = S_e + A(B + N)^{-2.63}$. The effect of the normal stress acting on the plane of critical shear stress is introduced linearly in a theory for fatigue under combined stress. The merits of this theory and three other theories of failure are discussed, and the effect of number of cycles to failure on the fatigue strength criteria was determined. The possible effect of anisotropy on fatigue behavior was discussed in terms of theories of failure which include the effect of the normal stress. The possibilities of a more exact theory which include a non-linear influence of normal stress and the influence of slip distribution are mentioned. (auth)

6696 NAA-SR-Memo-1115
North American Aviation, Inc., [Downey, Calif.].
THE INVESTIGATION OF THE EFFECTS OF SODIUM ON SRE CORE MATERIALS. F. E. Bowman. Oct. 4, 1954. Decl. June 6, 1956. 5p. $1.80(ph OTS); $1.80(mf OTS).

An experimental program to investigate Na effects at elevated temperatures on Zr in order to establish the feasibility of using Zr in a Na system at temperatures above 1000°F was proposed and outlined. (F.S.)

6697 NP-5893
Illinois Inst. of Tech., Chicago.
THE EFFECT OF DISSOLVED ELEMENTS OF THE RATE OF ISOTHERMAL GRAIN GROWTH IN METALS. Final Report. L. F. Mondolfo. Feb. 29, 1956. 80p. Project No. 6051. Contract DA-11-022-ORD-877.

The effect of alloying elements in varying amounts on the rate of grain growth in high-purity Fe was studied to permit determination of the effect of various elements on the n values in the formula $D = kt^n$ where D = average grain diameter, t = time, and n and k = constants which depend on the material. For quantitative results, materials much purer than those used in the investigation are needed, and there were indications that the n coefficient in the equation is not a function of temperature in Fe and its alloys. (J.E.D.)

6698 NP-5897
Climax Molybdenum Co. of Michigan, Detroit.
ARC-CAST MOLYBDENUM-BASE ALLOYS. Summary Report. M. Semchyshen and R. Q. Barr. 1955. 441p. Project NR-039-002. Contract N8onr-78700.

Classification of alloy systems of molybdenum according to solid solubility and the nature of the first excess phase developed in molybdenum-rich compositions, and establishment of certain phase diagrams are reported. Determination of mechanical properties of both cast and wrought molybdenum-base alloys over a wide temperature range, as a function of concentration of alloying elements and determination of the effects of alloy content on the rate of strain hardening of molybdenum and on recrystallization of the strain hardened metal were made. Investigation of the effects of added elements on control of deleterious impurities such as oxygen in molybdenum produced by the arc-cast process, and the indirect effect of each element on the hot working characteristics of molybdenum and the effects of variations in the melting and casting process on hot plasticity are presented. The exploration of binary alloy systems of molybdenum which are amenable to heat treatment for the control of mechanical properties were made. Development of hot working procedures for alloy ingots, investigation of the embrittlement resulting from exposure to high temperatures, investigation of the effect of variation in strain hardening on mechanical properties and the recrystallization temperature, determination of the effects of alloying elements on the rate of oxidation of molybdenum at temperatures near 1800°F, and preliminary investigation of protection against oxidation, are reviewed. (auth)

6699 NP-5903
Metallurgical Advisory Committee on Titanium.
MINUTES OF PHYSICAL METALLURGY SYMPOSIUM HELD AT WATERTOWN ARSENAL, WATERTOWN, MASS., SEPTEMBER 21 AND 22, 1955. 70p.

6700 NP-6020(Vols. I and II)
Syracuse Univ., N. Y. Research Inst.
STRENGTH LIMITATIONS OF METALS. Proceedings of the 1955 Sagamore Research Conference Conducted at Sagamore Conference Center, August 24, 1955 to August 26, 1955. Volumes I and II. Mar. 1956. (Vol. I, 204p.; Vol. II, 199p.). Contract DA-30-115-ORD-667.

These two volumes were issued separately, but are cataloged as a unit.

The proceedings of the conference covered reports on the general problems of strength limitations of metals, fundamental factors which determine the strength of alloys, factors limiting high strength and application of alloys, high strength steels, and high-strength Ti, Al, and Mg alloys. (J.E.D.)

6701 NP-6031
Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.
A STATISTICAL FORMULATION FOR CREEP OF METALS. Technical Report No. LVI. J. Lambert Bates, Taikyue Ree, and Henry Eyring. June 15, 1956. 39p. Project NR-032-168. Contract N7-onr-45101.

Statistical formulation for creep of metals has been developed involving the "dislocation domain" areas, which include the dislocation and atoms that are associated with

it in its movement from one relaxation site to another, occurring during the deformation process. (R.V.J.)

6702 NRL-4638

Naval Research Lab., Washington, D. C.

ELECTRICAL RESISTANCE STUDY OF THE EFFECTS OF OXYGEN ON THE ALLOTROPIC TRANSFORMATION OF TITANIUM. Leland A. DePue and E. J. Chapin. Sept. 6, 1955. 24p.

The limits of the $\alpha + \beta$ region of the $Ti-O_2$ system in the range to 2 wt. % (5.75 at. %) O_2 were established by measurements of electrical resistance vs temperature for 8 oxygen systems prepared from high-purity materials. The beginning of α to β transformation was established at 867 ± 2°C. The $\alpha/(\alpha + \beta)$ boundary agrees with previous established boundaries except at oxygen contents below 0.2 wt. %; the $(\alpha + \beta)/\beta$ boundary shows a higher β transus than that established by other investigators and is from 50 to 70°C higher than an earlier boundary established metallographically. The retention of small amounts of highly stable residual β phase after transformation from β to α was indicated. (auth)

6703 NRL-4761

Naval Research Lab., Washington, D. C.

EFFECT OF GEOMETRY ON THE PROPERTIES OF 195-T6 AND 356-T6 ALUMINUM ALLOY CASTINGS. W. H. Johnson and H. F. Bishop. May 17, 1956. 15p. Project Nos. NR 642-030 and NS 014-100.

Tensile properties were determined at various locations in cast aluminum alloy (195-T6 and 356-T6) castings of different thicknesses and geometries and compared with properties obtained from separately cast test bars. The properties of the 195 alloy castings were shown to be more sensitive to cooling rates than those of the 356 alloy. The properties of the 195 alloy castings are also affected to a greater extent by section thickness variations than for the case of 356 alloy castings. It is shown that special molding and melting processes may be used to develop properties in castings which approach (alloy 356) or exceed (alloy 195) test bar properties. (auth)

6704 NYO-7052

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

SOLID SOLUTIONS AND GRAIN BOUNDARIES. Progress Report No. 30. B. L. Averbach, M. Cohen, M. Hillert, R. Kaplow, and A. Schogel. Sept. 30, 1955. 5p. Contract AT(30-1)-1002, Scope II. $0.10(OTS).

Thermodynamic and x-ray techniques are being combined in a study of fundamental behavior of solid solutions. Several aspects of the atomic arrangement are being studied directly and progress in the measurements of short range order and Huang effect are reported. (auth)

6705 NYO-7077

Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy.

FUNDAMENTALS OF COLD WORKING AND RECRYSTALLIZATION. Progress Report No. 21. B. L. Averbach, M. Cohen, S. Allen, M. F. Comerford, C. Houska, and L. Mager. Sept. 30, 1955. 4p. Contract AT(30-1)-1002, Scope III. $0.10(OTS).

Based on previous x-ray and calorimetric work on retained energy in the Ag–75 wt. % Au alloy, measurements have been taken on the short range order regained at various annealing temperatures. Imperfections and their effect upon the martensitic transformation in the Co–Ni system, and recovery range and recrystallization in brass have been measured. (R.V.J.)

6706 NYO-7439

Carnegie Inst. of Tech., Pittsburgh. Metals Research Lab.

FUNDAMENTAL STUDY OF THE EARLY STAGES OF SINTERING. Annual Report. F. N. Rhines and R. F. Mehl. Mar. 9, 1956. 11p. Contract AT(30-1)-1826. $3.30(ph OTS); $2.40(mf OTS).

Studies of structural changes that accompany the early states of sintering of a mass of metal powder revealed that particles move first away from each other and then move bodily toward one another under the influence of surface forces that can be measured and partly rationalized. The research work included the perfection of experimental methods, the development of a new topological approach to measurements of internal surfaces and of the relative numbers of interparticle contacts, as a function of time, and the measurements of the progress of sintering in terms of both density and surface forces. Atomized oxygen-free copper shot, uncompacted and sintered in hydrogen for various times, at various temperatures, has been used in the investigation. (auth)

6707 OSR-TN-56-66

University of Notre Dame, South Bend, Ind. and Northwestern Univ., Evanston, Ill. Northwestern Technological Inst.

TRANSFORMATION IN DISORDERED GOLD COPPER ALLOYS. G. C. Kuczynski, M. Doyama, and M. E. Fine. Mar. 1, 1956. 31p. Contract AF-18(600)-1468. (AD-81058).

By measurement of the specific heat, temperature coefficient of expansion, Young's modulus, and yield point in Cu_3Au alloys, it was established that this alloy undergoes a phase transition between 550 and 600°C and possibly another one near 850°C. The temperature of the 550 to 600°C transition decreases sharply as the composition of the alloy deviates from Cu_3Au. (auth)

6708 OSR-TN-56-102

Princeton Univ., N. J. Forrestal Research Center.

THE REACTIONS OF IRON–NICKEL ALLOYS WITH OXYGEN. Metallurgy Report No. 5. M. J. Brabers, W. J. Heideger, and C. E. Birchenall. Feb. 29, 1956. 17p. Contract AF18(600)-967. ([AD]-82015).

Iron–nickel alloys of several compositions were partially oxidized and then equilibrated by maintaining them in a closed system at 1050 or 1095°C for an extended period. The products were examined microscopically, by x-ray diffraction, and by chemical analysis to determine their structure and composition. The three-phase field for alloy–wustite–spinel was located approximately, and the sense of some of the two-phase tie lines was established. It is possible to rationalize much of the earlier work on the kinetics of oxidation of iron–nickel alloys and to estimate the importance of some sources of error in the determination of thermodynamic activities by the formation of thin oxide films in hydrogen–water vapor mixtures. (auth)

6709 PA-TR-2106

Picatinny Arsenal. Samuel Feltman Ammunition Labs., Dover, N. J.

THE DETERMINATION OF TIN, IRON, AND MOLYBDENUM IN TITANIUM OR TITANIUM ALLOYS. Irving Kolier and Charles Ribaudo. Jan. 1955. 24p. Project No. Tb4-15. (AD-55284).

A method has been developed for the determination of Sn, Fe, and Mo in Ti and Ti alloys. The method involves the solution of the sample in concentrated HCl, oxidation with H_2O_2, and dilution to a specific volume. An aliquot of the solution is placed on a strip of specially prepared filter paper and chromatographed using a butanol–HCl solvent mixture for a period of 4 to 6 hr. The Sn, Fe, and Mo are separated from Ti and in many cases from each other in well-defined bands by ascending chromatography. The bands containing the metals are then cut from the

paper strip. The Sn is determined polarographically. The Fe and Mo are determined colorimetrically. (auth)

6710 SO-2047

General Electric Co. Research Lab., Schenectady, N. Y.
FUNDAMENTAL RESEARCH IN PHYSICAL METALLURGY. Thirtieth Quarterly Report. (Progress Report No. 47). R. E. Hoffman, R. A. Oriani, and D. Turnbull. July 5, 1956. 4p. Contract W-31-109-Eng-52. (56-RL-1578). $1.80(ph OTS); $1.80(mf OTS).

Small additions (ca.1 at.%) of Ge, Pb, or Tl to silver apparently cause a considerable decrease in the rate of silver self-diffusion along grain boundaries. This effect is decreased somewhat by a high-temperature (850°C) pre-diffusion anneal. No autoradiographic evidence was found for segregation of these solutes at grain boundaries. The operation of the differential solution calorimeter for measuring the enthalpy of formation of alloys has been evaluated. (auth)

6711 TID-5327

Division of Construction and Supply, AEC.
STAINLESS STEEL. Construction and Engineering Memorandum No. 24. Gardiner Luce, comp. July 1956. 26p. $0.25(OTS).

A review, history, and industrial applications of stainless steel are given. Steel production figures, properties and special uses of "stainless" alloys and steels are tabulated and a bibliography is included. (R.V.J.)

6712 TID-8012

Technical Information Service, AEC.
STEEL FOR NUCLEAR ENERGY. R. C. Daizell, Div. of Reactor Development, AEC. [nd]. 9p. $0.15(OTS).

One of Its monograph series "The Industrial Atom."

Present-day uses of stainless steel in the nuclear industry, which include fuel-element fabrication and construction materials for reactors and fuel processing plants, are reviewed. The effects of alloying elements on the mechanical and nuclear properties of stainless steels are discussed. Future applications will depend on the development of steels with increased corrosion resistance and tensile strength at high temperatures. Thermal neutron cross sections for several elements and stainless steel are tabulated. (C.W.H.)

6713 TML-35

Battelle Memorial Inst., Titanium Metallurgical Lab., Columbus, Ohio.
A DISCUSSION OF THE DESIGN OF RIVETED AND BOLTED JOINTS IN TITANIUM SHEET. S. A. Gordon. Feb. 27, 1956. 28p. Contract AF18(600)-1375.

One of the areas of design interest in the consideration of Ti at elevated temperatures is in the field of riveted and bolted joints. A survey of the literature on the subject disclosed no data on joints at elevated temperature, but some data on joints at room temperature were available. In order to provide some basis for estimating the behavior of joints at elevated temperature, design data on sheet, including shear and bearing values at elevated temperatures, are presented. It is suggested that room-temperature results be extrapolated to elevated temperature by the ratio of F_{tu} (at desired temperature)/F_{tu} (at room temperature) as an interim measure. (auth)

6714 WADC-TR-52-322(Pt. 4)

Battelle Memorial Inst., Columbus, Ohio.
CAUSES OF CRACKING IN HIGH-STRENGTH WELD METALS. [Summary Report for] November 15, 1954 to November 15, 1955. A. L. Lowe, Jr., R. P. Sopher, and P. J. Rieppel. Nov. 1955. 41p. Project title: METALLIC MATERIALS. Task title: CAUSES OF CRACKING IN HIGH-STRENGTH WELD METALS. Contract AF33(616)-2734.

Experimental works were conducted at Battelle to determine the causes of cracking in high-strength weld metals. A new hot-tension machine was designed and built to facilitate the testing of SAE 4340 weld metals on cooling from the molten state. The tests were conducted over the temperature range from 2600 to 100°F. Results from the studies showed P to be detrimental to weld-metal cracking resistance. As the P was increased the ductility was lowered at temperatures near the solidus. Nitrogen content within the normal range of SAE 4340 steels appeared to have little influence on the cracking resistance of the weld deposits. Rare-earth metal additions improved the hot ductility and hot-cracking resistance of the weld metals. An increase in Si lowered the hot ductility and hot-cracking resistance slightly. (auth)

6715 WADC-TR-53-162(Pt. 3)

Missouri School of Mines and Metallurgy, Rolla.
ELECTRODEPOSITION OF TITANIUM. Period covered: December 1954 to December 1955. Albert W. Schlechten, Martin E. Straumanis, and Sheng Tai Shih. Mar. 1956. 58p. Project title: FINISHES AND MATERIALS PRESERVATION. Task title: ELECTRODEPOSITION AND ELECTROCHEMICAL TREATMENTS. Contract AF33(616)-75.

Processes are described by which diffusion coatings of titanium can be obtained on iron and steel objects. A fused chloride bath containing a titanium–oxygen alloy powder operated under helium was particularly effective. It was shown that the coating mechanism of this process was only partially due to the formation of titanium lower chlorides. Coatings were also obtained by deposition from the vapor state, using iodide or chloride vapors. The physical properties of the coatings are described. (auth)

6716 WADC-TR-55-150(Pt. 1)

Battelle Memorial Inst., Columbus, Ohio.
MATERIALS-PROPERTY-DESIGN CRITERIA FOR METALS. [Period covered] January 1954 to January 1955. Jan. 1956. 171p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN DATA FOR METALS. Contract AF33(616)-2303. (AD-90286).

Investigation was undertaken and is reported on the development of recommended design values at elevated temperatures for steels; studies of the available data on bending and torsional moduli of rupture of steel and of Al round tubing; fatigue data on Mg alloys; a survey of available data on stainless steels and superalloys; a study of available data on spot-welded joints at depressed and elevated temperatures; and the Al- and Mg-base alloys suitable for sand-, permanent-mold-, and die-casting applications. (F.S.)

6717 WADC-TR-55-150(Pt. 2)

Battelle Memorial Inst., Columbus, Ohio.
MATERIALS-PROPERTY-DESIGN CRITERIA FOR METALS. PART 2. A STUDY OF METHODS OF PRESENTING CREEP DATA FOR AIRFRAME DESIGN. [Period covered] October 1954 to April 1955. W. S. Hyler and H. J. Grover. Nov. 1955. 41p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: DESIGN DATA FOR METALS. Contract AF 33(616)-2303. (AD-90283).

A study was made of methods of presenting creep data from the standpoint of usefulness to the designer of airframes. These methods included: stress-time graphs, stress-temperature graphs, Larson-Miller graphs, and isochronous stress-strain graphs. Consideration was given to current practices and needs of personnel in the aircraft structures field. Also, consideration was given to the use of creep data in particular problems associated with high-speed flight. On the basis of this study, it

appears that a particularly useful method of presenting creep data is that of the stress-temperature graphs (with time as a parameter). It is also believed in some applications that the isochronous stress-strain graph may be a particularly desirable presentation, since useful engineering approaches for certain high-temperature problems have been advanced based on these graphs. This latter presentation should be considered tentative pending verification of these engineering approaches by experimental studies. (auth)

6718 WADC-TR-55-501

Sylvania Electric Products, Inc. Metallurgical Labs., Bayside, N. Y.

DEVELOPMENT OF HEAT RESISTANT ALLOYS BY POWDER METALLURGY TECHNIQUES. [Period covered] May 1, 1954 through September 30, 1955. G. Zuromsky, L. Sama, H. S. Kalish, and L. L. Seigle. Mar. 1956. 74p. Project title: METALLIC MATERIALS. Task title: HIGH TEMPERATURE ALLOYS. Contract AF33(616)-2401.

Powder metallurgical techniques were utilized in the production of Cr–W–Co alloys, to meet a stress rupture specification of 100 hr life at 870°C and 25,000 psi. Attempts to produce chromium-base alloys with room temperature ductility and/or high density were unsuccessful. The use of a master alloy improved the densities of the cobalt-base alloys. Stress-rupture properties of the cobalt-base alloys at 870°C and 25,000 psi appeared to approach those of the weaker Stellites but failed to meet the 100-hr requirement. Nickel additions lowered the stress-rupture strength but gave increased ductility. Attempts to retain carbon as an alloying addition were unsuccessful. (auth)

6719 WADC-TR-56-33

Battelle Memorial Inst., Columbus, Ohio.

THE EFFECT OF METAL PURITY ON CHROMIUM-BASE ALLOYS. D. J. Maykuth, R. I. Jaffee, and J. M. Blocher, Jr. Jan. 1956. 46p. Project title: METALLIC MATERIALS. Task title: CORROSION AND HEAT RESISTANT ALLOYS. Contract AF33(616)-2696.

Binary alloys over the entire range of Cr with Fe, V, Mo, W, Nb, Ta, Ni, and Co were prepared by arc melting, using Cr of 99.99+ per cent purity, to determine the maximum Cr content commensurate with good fabricability and room-temperature ductility. Room-temperature tests on the wrought Cr base showed excellent ductility, much higher than previously reported for this metal. Of the alloy systems investigated, only the Cr–Fe, Cr–Ni, and Cr–Co systems showed an extensive range of fabricable compositions. The limiting Cr contents for obtaining wrought sheet in these systems were determined as 76 at. per cent Fe, 63 at. per cent Ni, and 45 at. per cent Co. Bend and tensile tests on the workable alloys showed that the Cr–Ni alloys have the best combinations of strength and ductility. Duplicate ingots, made with less pure Cr, showed that O, S, and N, in the amounts contained in commercial Cr, impart hot shortness to Cr-rich Cr–Fe, and Cr–Ni alloys. Use of high-purity Cr in these alloys also results in improved room-temperature tensile ductility. Work with a limited number of high-purity ternary Cr–Fe base alloys showed that use of tungsten, as a ternary addition, results in significant improvements in the properties of the Cr–Fe base. (auth)

6720 WAL-111/7-3

Harvard Univ., Cambridge, Mass.

PLASTIC PROPERTIES OF STEEL. THE COLLAPSE OF HOLLOW CYLINDERS UNDER EXTERNAL PRESSURE. P. W. Bridgman. Oct. 8, 1943. 40p.

Problems of plastic behavior of metals at large deformations are investigated by a special method of collapsing hollow cylinders. Mathematical analysis and complete tabulations are presented. (R.V.J.)

6721 WAL-401/173-10

Worcester Pressed Steel Co., Mass.

EVALUATION OF DRAWABILITY OF TITANIUM. Final Report. James W. Hillhouse. 1956. 100p. Project No. TB4-15. Contract DA-19-020-ORD-2331.

This investigation was conducted to determine the deep drawing characteristics of commercially pure Ti and certain of its alloys. Materials tested were alloy C-110M containing 8% Mn, and alloy A-110AT containing 5% Al and 2½% Sn. The program included variation of gage of material, speed of the draw punch, temperature of material and draw dies, and diameter of material blanks being tested. The choice of a hydraulic draw press gave a constant draw speed not possible to achieve in the mechanical crank press. Punch speed range was from 5 to 6 ft/min. down to under 1 ft/min. All Ti draws were attempted within this speed range. All testing was limited to first draw only. (auth)

6722 WAL-401/232

Illinois Inst. of Tech., Chicago. Armour Research Foundation.

THE DIRECT DETERMINATION OF OXYGEN AND NITROGEN IN TITANIUM AND TITANIUM ALLOYS USING BROMINE TRIFLUORIDE. Final Technical Report [for] June 30, 1954 through September 30, 1955. W. A. Dupraw. Feb. 22, 1956. 25p. ARF Project No. C 063. Contract DAI-11-022-ORD-(P)-7.

The bromine trifluoride method for the determination of residual O_2 and N_2 in Ti and Ti alloys is described. Bromine trifluoride reacts with Ti to form TiF_4 and with H_2 (an impurity) to form HF. Following the removal of these halide reaction products, the volumes of the unreacted O_2 and N_2 are measured. (C.W.H.)

6723 AEC-tr-2494

THE EFFECT OF TEMPERATURE ON THE STRENGTH OF BRITTLE METALLIC SUBSTANCES. V. V. Baron and E. M. Savitskii. Translated by F. L. Yaggee from Doklady Akad. Nauk S.S.S.R. 94, 269-72(1954). 6p.

Measurements taken of the temperature effects on brittle metallic compounds showed that the initial strength of such materials increases with the increase of the temperature, reaches the maximum value, and then begins to decrease according to the exponential law, while their plasticity continues to increase with the temperature. Analysis is made of temperature effects during compression and tension. Tabulations are given for variations in strength and plasticity of brittle metals, metallic compounds, and plastic metals and alloys. Tests were made with samples of Cu, Co, Si, Ge, Ni and their compounds. (R.V.J.)

6724 AEC-tr-2495

MEASUREMENT OF SMALL VAPOR PRESSURES AT ELEVATED TEMPERATURES. IV. THE PARTIAL VAPOR PRESSURES OF THE COMPONENTS IN THE SYSTEM Ag–Pb. A. A. Granovskaya and A. P. Lyubimov. Translated by F. L. Yaggee from Zhur. Fiz. Khim. 27, 1437-42(1953). 9p.

A method has been developed for measuring the partial pressures of components in a binary alloy, combining the determination of the rate vaporization from an exposed surface with the determination of concentration by the use of radioactive atoms. Partial pressures of Ag–Pb components were measured at 927, 1085 and 1217°C. The activities, chemical potentials, heat contents and entropies of the components in Ag–Pb alloy were calculated from the experimental data. It has been shown that in Ag–Pb alloy the deviation from the ideal state decreases as temperature increases. (auth)

6725 AEC-tr-2497

AN EXPERIMENTAL INVESTIGATION OF THE SURFACE TENSION OF SODIUM AMALGAMS. P. P. Pugachevich and O. A. Timofeevicheva. Translated by F. L. Yaggee from Doklady Akad. Nauk S.S.S.R. 94, 285-7(1954). 4p.

Results are reported of the experimental investigation of the surface tension of sodium amalgam containing from 8×10^{-5} to 0.284 at.% of Na. The surface tension measurements were conducted at 22°C under high vacuum. Surface tension of Hg drops by 2 to 3 dynes/cm even at 8×10^{-5} at.% Na (1 gr Na per 10 tons of Hg). In contrast to previous works, no especially small values on the surface tension isotherm has been observed. It was concluded that the adsorption scheme in metallic solutions is much simpler than was previously suggested. (R.V.J.)

6726 AEC-tr-2522

THERMODYNAMIC ANALYSIS. II. THE HEAT CONTENT CURVE OF A MATERIAL FROM A SINGLE CALORIMETRIC EXPERIMENT. Willy Oelsen, Karl Heinz Rieskamp, and Olaf Oelsen. Translated from Arch. Eisenhüttenw. 26, 253-66(1955). 48p.

A simple calorimetric method permitting a continuous determination of heat contents for condensed materials over a large temperature range has been developed and tested. Heats of fusion for Pb, Bi, Cd, Sn, In, Tl, Zn, and Al, as well as the heat content and heat of transformation for Tl, Pb, Cd, and lead-rich alloys and soft iron in the temperature range of 25 to 1050°C has been tabulated. The heat content curve is given for unalloyed steel containing 0.96% C, and iron–phosphorus alloy with 1% P. Heat content and specific heats of Ni, and heats of transformation of irreversible Fe–Ni alloy with 15% Ni have been calorimetrically determined. (R.V.J.)

6727 AERE-Lib/Trans-568

STRESS CORROSION PHENOMENA IN MECHANICALLY STRAINED STEEL DUE TO DIFFUSING HYDROGEN. I. Class. Translated by R. J. Richardson from Werkstoffe u. Korrosion 6, 237-45(1955). 20p.

6728 AERE-Lib/Trans-577

SURFACE CONTACTS UNDER HIGH PRESSURE. Dietrich Müller-Hillebrand. Translated by F. Hudswell from Wiss. Veroffentl. Siemens-Werken 20, 85-103(1941).

Contract resistances of Cu, Al, Mg, Zn, Ag, and Sn oxidized surfaces were measured at high pressure. The contact resistance of Cu, Al, and Mg increased sharply after a certain length of storage in drying over at 125°, while Ag, Zn, and Sn did not show any appreciable change providing no moisture interfered in the formation of foreign layers. (R.V.J.)

6729 AERE-Lib/Trans-619

THE DIFFUSION OF ANTIMONY, ARSENIC AND INDIUM IN SOLID GERMANIUM. W. Bösenberg. Translated by F. Hudswell from Z. Naturforsch. 10a, 285-91(1955). 13p.

6730 AERE-Lib/Trans-676

DEEP-DRAWING TESTING ON THIN STRIPS. A. Krisch. Translated by R. J. Richardson from Stahl u. Eisen 74, 1591-4(1954). 11p.

Deep-drawing experiments were made on brass and steel strips, 0.10 to 0.40 mm in thickness and 70 mm in width, with the DIN 50,101 instrument and various hold-down forces. Dependence of the deep-drawing value on the hold-down force was studied. Significant of the development of folds outside the instrument was determined. Experiments were made with an instrument whose external diameter is larger than the width of the strip. (auth)

6731

NUCLEAR METALLURGY—A SYMPOSIUM CONDUCTED BY INSTITUTE OF METALS DIVISION, OCTOBER 17, 1955. IMD Special Report Series No. 1. New York, American Institute of Mining and Metallurgical Engineers, 1955. 126p. $3.75.

The reports presented at the symposium included power reactors, problems in materials for nuclear power, methods used in handling Pu in research and metallurgical operations and properties of the pure metal, physical metallurgy of Th and U. (J.E.D.)

6732

HOW TO WELD ZIRCONIUM. Hugh Justis and Chester Lawrence (Glenn L. Martin Co., Baltimore). Iron Age 177, No. 12, 79-81(1956) Mar. 22.

In the resistance welding of Zr no protective atmosphere is needed, but the metal should be cleaned chemically or mechanically to insure the best possible welding conditions. (auth)

6733

HOW TO AVOID CRACKS IN WELDING STABILIZED STAINLESS STEEL. W. L. Fleischmann (Knolls Atomic Power Lab., Schenectady, N. Y.). Iron Age 178, No. 2, 76-8 (1956) July 12.

Type 347 stainless steel is readily weldable but some fabricators have troubles with cracking in weld deposits and adjacent heat-affected zones. Niobium additions, beneficial for reasons other than welding, cause welding difficulties and associated troubles. Hints to improve welds are given. (F.S.)

6734

HARD ALLOYS OF METAL CERAMICS WITH IRREGULAR DISTRIBUTION OF CARBIDE COMPONENTS FOR TREATING ABRASIVE MATERIALS. G. A. Meerson and G. V. Samsonov (Moscow Inst. of Non-ferros metals and Gold). Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 4, 121-5(1956) Apr. (In Russian)

Hard alloys with controlled irregular distribution of carbide components and interlayers of viscous and cementing metal (cobalt) showed better wear resistance in friction contact with abrasive materials. On the surface of the hard alloyed instruments appeared protrusions of greater wear resistance than the surrounding surfaces. Microstructure tests made with stationary instruments of this type showed the wear resistance increases several times compared to the instruments manufactured from homogeneous hard alloys or the ones with grains of brass or bronze welded into them. (R.V.J.)

6735

DENSITY AND SURFACE TENSION OF LIQUID TITANIUM. V. P. Elyutin and M. Maurakh. Izvest. Akad. Nauk S.S.S.R. Otdel. Tekh. Nauk No. 4, 129-31(1956) Apr. (In Russian)

To determine the surface tension of liquid Ti tests are made lifting the liquid through a capillary tube. The apparatus is described. A sample containing 98.7% Ti, 0.1% Fe, 0.2% Si, 0.1% Ca, and 0.5% Mg was used. The mean density of Ti with 0.6 to 0.8% of carbon at the melting point was 4.11 ± 0.08 g/cm^3. To calculate the surface tension g was taken as 980 cm/sec^2, crucible diameter was 3.5 cm, and the tension was taken as g 980 cm/sec^2, crucible diameter was 3.5 cm and the density of liquid metal 4.11 g/cm^3. The mean value of the surface tension of Ti at crystallization temperature was 1510 ± 18 dynes/cm. Results of the experiment indicated the suitability of the method and apparatus for testing the surface tension of Ti, Ti alloys, or any other high-melting point, chemically active metal. (R.V.J.)

6736

EFFECTS OF NEUTRON IRRADIATION UPON THE YOUNG'S MODULUS AND INTERNAL FRICTION OF COPPER SINGLE CRYSTALS. Donald O. Thompson and David K. Holmes (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 27, 713-23(1956) July.

Measurements of neutron irradiation effects upon the Young's modulus and logarithmic decrement of a set of copper single crystals of 99.999% purity have been made at room temperature. Interpretation of the results can best be given in terms of an oscillating dislocation line mechanism in which the oscillations are suppressed by the presence of interstitial atoms, vacancies, or some combination thereof. Comparisons of the results with the predictions of impurity line pinning are given. It is shown that an interpretation in this sense leads to generally accepted values for the dislocation densities and average segment lengths. (auth)

6737

THE SOLID SOLUBILITIES OF TIN, INDIUM, AND CADMIUM IN ALUMINIUM. L. E. Samuels (Dept. of Supply, Australia). J. Inst. Metals 84, 333-6(1956) May.

A comparative examination, using an improved method of mechanical polishing, has shown that the solubilities of tin and indium in aluminium determined by a metallographic method using electrolytically polished specimens (Hardy, J. Inst. Metals, 1951-52, 80, 431) are in error because some of the effects observed were not, as was assumed, evidence of insoluble particles, but were due probably to the presence of segregated areas in the solid solution. Similar effects observed in aluminium-cadmium alloys in the same investigation, however, do appear to be due to undissolved particles which, when present, can be detected in all three of the alloy systems with high sensitivity after preparation by the mechanical method of polishing; consequently, it has been possible to make more reliable estimates of the solubility limits by using this method. The new determinations indicate that the solubilities of indium and cadmium increase to maximum values of 0.17 and 0.47%, respectively, at their monotectic temperatures. Aluminium–tin alloys appear to show a slightly retrograde curve, with a maximum solubility of 0.11% at about 640°C. (auth)

6738

THE STRUCTURE AND GROWTH OF OXIDE LAYERS FORMED ON BERYLLIUM. I. S. Kerr and H. Wilman (Imperial College of Science and Technology, London). J. Inst. Metals 84, 379-85(1956) June.

An electron-diffraction study of oxide layers on beryllium has established that on polycrystalline metal surfaces, at 300°C. and over, the oxide developed in a one-degree orientation which varied with the temperature of formation. On abraded beryllium below 700°C., the BeO grew in the (001) orientation, but above 700°C. in {100}. The oxide formed on smooth, electropolished, coarsely crystalline beryllium at temperatures up to 250°C. had a grain-size of about 10 A., but that formed at 300°C. and above measured 60 A or more, with preferred (001) orientation up to 700°C. Growth of the oxide in air at room temperature was not increased by irradiation with ultra-violet light. On vacuum-deposited beryllium surfaces, the oxide grew epitaxially on the exposed (001) and (110) metal faces, even though at room temperature the grain-size of the oxide crystals was only about 10 A. This striking case of epitaxy under conditions of extremely limited surface mobility was thus observed at a stage only a little beyond that at which the initial nuclei originate from chemisorption. Anodic BeO layers, formed in a nitric-chromic acid solution, grew at a constant rate up to several thousand A. thickness, with a linear current/voltage relationship. The initial very thin BeO layers were amorphous, but on reaching a thickness of 100–150 A. and subsequently, the surface consisted of randomly disposed BeO crystals, 60 A or more in diam, indicating that in this and similar cases the surface temperature of the growing deposit considerably exceeds 300°C. (auth)

6739

ALUMINIUM AND ITS ALLOYS IN 1955. SOME ASPECTS OF RESEARCH AND TECHNICAL PROGRESS REPORTED. E. Elliott. Metallurgia 53, No. 316, 69-79(1956) Feb.

Research and technical progress in various aspects of the metallurgy of Al and Al alloys in the UK and USA are reported. Extraction, founding, fabrication, constitution, properties, and standardization are discussed. (J.E.D.)

6740

TRENDS IN THE WELDING OF ALUMINIUM ALLOYS. P. T. Houldcroft. Metallurgia 53, No. 316, 80-3(1956) Feb.

The trends in relation to Al alloy spot welding, arc welding, shipbuilding, high-test alloys, and cutting are reviewed. (auth)

6741

HOW STATISTICAL TECHNIQUES SOLVE METALWORKING PROBLEMS. PART II. Chester R. Smith (Mallory-Sharon Titanium Corp., Niles, Ohio). Metal Progr. 69, No. 3, 76-8(1956) Mar.

The application of statistical techniques and statistical inferences to the design of an experiment to study the effects of an alloying agent in Ti is discussed. (C.W.H.)

6742

METALLOGRAPHIC EVIDENCE OF MECHANICAL TWINNING IN AN ALPHA-BETA TITANIUM ALLOY. D. N. Williams (Battelle Memorial Inst., Columbus, Ohio). Nature 177, 436(1956) Mar. 3.

Metallographic examination of tensile fractures of C-130AM alloy (Al–Mn–Ti) heat-treated to produce acicular α in a β matrix has resulted in the observation of mechanical twinning. The twinned orientation is confined to the close-packed hexagonal α phase as no evidence is visible in the β phase. It was concluded that twinning occurs normally during the deformation process. (C.W.H.)

6743

THE PRODUCTION OF REACTOR FUEL ELEMENTS. I. FROM ORE TO URANIUM METAL. L. M. Wyatt (UKAEA Industrial Group HQ, Risley, England). Nuclear Power 1, 23-8(1956) May.

The basic design requirements for fuel elements, the principles underlying the choice of materials, and reactor operation effects on these materials are discussed. The Springfields process for the production of U metal from ores is described. (F.S.)

6744

ZIRCONIUM. PART 2. TREATMENT OF THE METAL. G. L. Miller. Nuclear Eng. 1, 111-15(1956) June.

Arc melting technqiues have been developed for the melting of Zr with automatic additive feeds for alloy production. Under appropriate conditions zirconium can be forged, rolled, extruded, swaged and drawn into wire or tube. Present world production is reviewed. (auth)

6745

DISLOCATION DENSITIES IN SOME ANNEALED AND COLD-WORKED METALS FROM MEASUREMENTS ON THE X-RAY DEBYE-SCHERRER SPECTRUM. G. K. Williamson and R. E. Smallman (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (8) 1, 34-46(1956) Jan.

Two basic equations are derived for deducing the dislocation density in powdered materials from the particle size and strain breadth measured from the Debye-Scherrer spectrum. In the particle size estimate, it is assumed that the materials has a block structure similar to that found in microbeam studies and that the dislocations lie along the block surfaces. The number of dislocations along each face, n, is not known. In the strain broadening estimate the x-ray line broadening from a dislocation array is calculated in terms of the broadening due to an isolated dislocation and a strain energy factor F, which allows for the effect of dislocation arrangement. Both methods involve an unknown

quantity but by equating the two results it is possible in most cases to get both a narrow bracket for the dislocation density and considerable information on the dislocation arrangement. (auth)

6746

RARE METALS. E. M. Savitskiĭ. Priroda 45, 24-30(1956) Apr. (In Russian)

A review is given of rare metals and their uses in industry. (R.V.J.)

6747

THE PERFORMANCE OF HIGH-STRENGTH PRESSURE-VESSEL STEELS. J. H. Gross and R. D. Stout (Lehigh Univ., Bethlehem, Penna.). Welding J. (N. Y.) 35, 115s-19s(1956) Mar.

Strength and ductility characteristics of A302, 48,5HT, 70B, 70A, 90A, and 90B are tabulated. The effects of stress relieving, strain aging, welding, and post heating on notch toughness of these steels are graphically presented. The 90A steel compares favorably with the standard steels in pressure vessel construction. (C.W.H.)

Refer also to abstracts 6824 and 7054.

PHYSICS

6748 ANL-5497

Argonne National Lab., Lemont, Ill.

PHYSICS DIVISION SUMMARY REPORT [FOR] MARCH AND APRIL 1955. May 1956. 109p. Contract W-31-109-eng-38. $0.55(OTS).

Experimental Nuclear Physics. Measurements on Pu^{239} were made with the fast neutron velocity selector. The measured cross sections in the range 0.1 to 90 ev are graphically presented. A scintillation counter study of I^{128} decay revealed gamma emission at 0.43, 0.98, and 0.72 Mev in addition to the x ray. An analysis of mass 153 and 155 decay spectra indicates transitions in addition to those previously reported. Diagrams of these schemes are given, and the observations are discussed. The β decay of H^3 is believed to leave a number of excited and ionized states of He^3. Plans for demonstrating this experimentally are reviewed. Optical observation of the excited states is believed feasible. An investigation of light output in scintillators showed increased output using a 3 : 2 : 2 mixture of biphenyl, naphthalene, and toluene instead of pure toluene. Attempted preparation of 4-methylbiphenyl scintillators is described. The results were unsatisfactory. A magnetometer design for measuring the field in the 180° β-ray spectrometer is outlined. Mass Spectroscopy. A method of preparing meteorite specimens for Pb analysis is described. This method reduces the Pb separation to a few hours. Experiments were designed for the observation of O^- emission from the electron bombardment of CO. The experimental apparatus is diagrammed, and a plot of emission intensity as a function of voltage is shown. Source design for ion bombardment of solid targets in the MA-17 mass spectrometer is described. Though the experimental results were inconclusive, they were promising. Emission energy plots for K^{39} and A^{40} are shown. Energy levels in the 1p shell of light nuclei were investigated. Four sets of parameters were used in matrix diagonalization and the results compared with experimental values for mass 10 nuclei. Computer operation for the period is reviewed. (For preceding period see ANL-5420.) (D.E.B.)

6749 BNL-388

Brookhaven National Lab., Upton, N. Y.

QUARTERLY PROGRESS REPORT [FOR] JANUARY 1–MARCH 31, 1956. (Unclassified Section). 61p. $0.40 (OTS).

Abstracts of reports on biological, chemical, and physical research published or submitted for publication in journals during the report period are given. Cosmotron operation, accelerator development, reactor operation, instrumentation developments, and health physics experience are reviewed. (For preceding period see BNL-375.) (D.E.B.)

6750 NP-5904

Utah. Univ., Salt Lake City. Inst. for the Study of Rate Processes.

THE DETERMINATION OF REACTION RATES OF NONIDEAL EXPLOSIVES FROM SHAPED CHARGE PENETRATION DATA. Technical Report XLVII. A. M. Spener. Aug. 19, 1955. 54p. Project 357 239. Contract N7-onr-45107.

Penetration data and the calculated ideal detonation pressures of a large number of shaped charges employing ideal explosives were obtained and used to establish calibration curves for the measurement of the effective shaped charge pressures of nonideal explosives. The effective pressures of various nonideal explosives were determined from the measured hole volumes and depths of penetration by use of these calibration curves. These effective pressures were then used to compute the reaction rates by means of theoretical reaction rate or total reaction time equations developed from considerations of the detonation head or geometrical model for both single and two-component spherical grain explosives. The results from several nonideal explosives appeared to be in reasonable agreement with this model. The average pressure effective in jet formation was found to be appreciably less than the detonation pressure computed from the measured velocity for the nonideal explosives. This effect is in accord with the long reaction times predicted by the detonation head model but evidently is not in agreement with the reaction times given by nozzle or curved front theories since the average or effective pressure and the detonation pressure should be practically identical for the short reaction times predicted by the latter two theories. Besides the penetration data, the jet velocities for the first 1.5 to 2 ft of travel were determined for some of the explosive charges used in this study. (auth)

6751 NP-5990

Mine Safety Appliances Co., Callery, Penna.

THIRD FLUID TUBE SHEET HAZARD TEST. Memo Report 101. W. Milich, E. A. Schultz, E. C. King, and R. E. Lee. Dec. 28, 1955. 9p. Contract NObs-65426.

Tests were made to determine the extent of the hazard in event of tube failure between water and third fluid NaK in an evaporator. Three tests were made simulating as closely as possible a third fluid NaK-to-water break at the tube sheet. The tests were run in a horizontal and 30 pitch either way, forcing the 200°F water into the 700°F NaK under 200 psig driving pressure. There was no immediate hazard or reaction of explosive violence during the runs. At the time of rupturing the disc between the NaK and water, the pressures on both sides equalized almost instantly and continued to hold for some time. (auth)

6752 NP-6012

Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

QUARTERLY PROGRESS REPORT NO. 41 [FOR] PERIOD ENDING FEBRUARY 29, 1956. J. B. Wiesner, G. G. Harvey, and H. J. Zimmermann. Apr. 15, 1956. 137p. DA Project 3-99-10-022. Contract DA-36-039-sc-42607, Project 102B.

Detailed reports of progress made in research on micro-

wave electronics, physical electronics, statistical communications theory, processing and transmission of information, and communications biophysics are given. Brief summaries of the progress made on mechanical translations, atomic beams, microwaves, multipath transmission, and noise in electron devices are included. (F.S.)

6753 NRL-Memo-602
Naval Research Lab., Washington, D. C.
THERMAL AND RELATED PHYSICAL PROPERTIES OF MOLTEN MATERIALS. Progress Report No. 16 [for] November 1, 1955—January 31, 1956. Chemistry Div. B. E. Walker, C. T. Ewing, and R. R. Miller. June 6, 1956. 7p.

Preliminary heat content and specific heats have been determined on salt "D" from 30 to 700°C. Measurements are proceeding on salts and salt mixtures in the evaluation of the hypothesis concerning the prediction of specific heats of salt mixtures. The Monel apparatus used for thermal conductivity developed porosity which has prohibited the use of the Monel on hand for this purpose. (auth)

6754 NRL-Memo-603
Naval Research Lab., Washington, D. C.
THERMAL AND RELATED PHYSICAL PROPERTIES OF MOLTEN MATERIALS. Progress Report No. 17 [for] February 1—April 30, 1956. Chemistry Div. B. E. Walker, C. T. Ewing, and R. R. Miller. June 7, 1956. 6p.

The final determinations of heat content and specific heat of salt "D" have been completed over the range 30 to 900°C. Salt "F" is being measured to further evaluate the hypothesis on the prediction of specific heat on salt mixtures. For the thermal conductivity apparatus, Hastelloy B, Inconel, and vacuum poured Monel are being procured for use with the salt mixtures. (auth)

6755 ORNL-2076
Oak Ridge National Lab., Tenn.
PHYSICS DIVISION SEMIANNUAL PROGRESS REPORT FOR PERIOD ENDING MARCH 10, 1956. J. F. Fowler and E. O. Wollan, eds. July 6, 1956. 75p. Contract W-7405-eng-26. $12.30(ph OTS); $4.50(mf OTS).

The theory and experimental observations of α emission from oriented nuclei of Np^{237} and U^{233} are discussed. A table of nuclear data was prepared for Ru isotopes from an analysis of γ yields from Coulomb excitation. The design and operation of a polarimeter for γ rays from Coulomb excitation is discussed, and transition data for Ag, Cd, Mo, and Rh isotopes are tabulated. Polarization intensity ratios for Ta^{181} are also given. Scintillation spectrometer studies of the gamma emissions from Sr^{88}, Lu^{175}, Hf^{177}, and Sb^{125} were made. Angular correlations are reported for Sr, Lu, and Hf and a decay scheme is proposed for Sb. An investigation of the 2.07-Mev resonance in the $C^{12}(n,n)C^{12}$ reaction verified a $\frac{3}{2}$ spin for this level and established an 11-kev resonance width. Plots of total cross section and angular distribution were prepared. The performance of the Van de Graaff accelerator after the installation of a terminal pulser is described. Neutron total cross section plots for Mn and Se obtained with the new pulser are shown. The time constant for the decay of the fundamental mode of an enriched subcritical U^{235}—H_2O assembly was measured. Over the range of buckling 0.072 to 0.54 cm^{-2}, the measured half life varied from 64.2 to 17.9 μsec. Ionization following radioactive decay in Xe^{131m} was studied. The apparatus used in the study is described, and the charge spectrum following internal conversion is shown. A conceptual cascade was prepared which shows the possibility of a 29-fold ionization from an initial K shell vacancy. Neutron diffraction and paramagnetic scattering cross section studies were conducted on Ho_2O_3. The resulting plots are presented. The reaction $Bi^{207} \rightarrow Pb^{207m} \rightarrow Pb^{207}$ was used to indicate the feasibility of rapid separations by ion exchange techniques. The extent of separation is graphically shown. Investigations of light pipe transmission and subminiature tube filament lifetime, and an electrostatic lens design for the Van de Graaff are also reported. (For preceding period see ORNL-1975.) (D.E.B.)

6756 OSR-TN-56-248
Stanford Research Inst., Menlo Park, Calif.
THE OPERATION AND USE OF THE CALIFORNIA INSTITUTE OF TECHNOLOGY LENS-TYPE SOLAR FURNACE. Technical Report No. II. (Report No. 5). Nevin K. Hiester, Eugene Loh, and Thomas E. Tietz. Apr. 24, 1956. 27p. SRI Project No. CU-1410. Contract AF18(600)-1499. (AD-88368).

The CIT lens-type solar furnace is described, and the feasibility of its adaptation to high-temperature solid research is considered. Changes in atmospheric absorption and heat flux with sun position are discussed. (D.E.B.)

6757 P-562(RAND)
RAND Corp., Santa Monica, Calif.
REVISIONS AND EXTENSIONS TO THE SIMPLEX METHOD (WITH SIDE-LIGHTS ON PROGRAMMING TECHNIQUES). William Orchard-Hays. Sept. 2, 1954. 23p.

Allowable revisions and extensions to the Simplex method which have resulted in machine economy are reviewed. (D.E.B.)

6758 RM-1386(RAND)
RAND Corp., Santa Monica, Calif.
ON THE CONTINUOUS SIMPLEX METHOD. R. Sherman Lehman. Dec. 1, 1954. 58p.

The continuous simplex method is a systematic technique for solving a class of problems arising in the theory of dynamic programming. This method is developed and applied to solve several bottleneck problems. (auth)

6759 RM-1440(RAND)
RAND Corp., Santa Monica, Calif.
NOTES ON LINEAR PROGRAMMING. PART VI. THE RAND CODE FOR THE SIMPLEX METHOD (SX4). (FOR THE IBM 701 ELECTRONIC COMPUTER). William Orchard-Hays. Feb. 7, 1955. 80p.

The fourth in a series of codes for the IBM 701 computer which performs the simplex method is described. Several additions, extensions, and adaptations of the basic simplex procedure have been provided for, but only the code as assembled for the revised simplex method on a primal system is explained in detail. The method is completely reviewed incorporating all modifications as used in the code. Appendix I contains certain "tricks" which may be applied to many problems. Appendix II describes the operation of the preliminary data assembly routine, and Appendix III describes the operation of the primal simplex code. Appendix IV gives further details of the various parts of the codes, while Appendix V illustrates the listing formats and printer board. (auth)

6760 AEC-tr-2500
THE PRODUCTION OF INTENSE PARTIALLY MONOCHROMATIC HYDROGEN MOLECULAR BEAMS WITH A LAVAL NOZZLE. E. W. Becker and K. Bier. Translated by E. H. Kobisk from Z. Naturforsch. 9a, 975-86(1954). 23p.

The possibility of producing an intense, partially monochromatic hydrogen molecular beam with a Laval nozzle was investigated in view of scattering experiments with crossed molecular beams employing the largest and most efficient pumping apparatus available at the present time. On the basis of systematic measurements, a beam production system was devised which yielded a stream density of 3×10^{17} particles/cm^2 sec into a surrounding vacuum of

1×10^{-5} mm Hg as measured 77 mm past the collimator diaphragm. Measurements indicate that the beam possesses an essentially uniform velocity distribution similar to a normal "furnace beam." The direct determination of velocity distribution was carried out in the course of the present work by a variable time method. (auth)

6761 AERE-Lib/Trans-573

MEASUREMENTS OF THE TIME CHARACTERISTIC OF THE HEATING EFFECT IN A CONTACT DUE TO A SUDDENLY ESTABLISHED CURRENT. H. Paul Fink and Hermann Körner. Translated by R. J. Richardson from Wiss. Veröffentl. Siemens-Werken 19, 280-90(1940). 17p.

Measurements were carried out which lend experimental support to a theory developed by R. Holm on the time characteristic of the heating effect in a contact due to a suddenly established current. As the exact mathematical treatment of this problem gives rise to very great difficulties which have not been solved heretofore, it was necessary to test experimentally the simplifications made in the Holm theory. It appeared that the simplifications made in regard to the graphic contact investigated are thoroughly permissible so that the theory was in general agreement with the experimental results. (auth)

6762 AERE-Lib/Trans-639

CALCULATION OF SURFACE TENSION BY SHAPE OF DROP. N. N. Krasovskii, Yu. P. Nikitin, O. A. Esin, and S. I. Popel. Translated by [S.] Botcharsky from Zhur. Fiz. Khim. 28, 1678-9(1954). 5p.

A calculation of the surface tension of liquids by the shape of a recumbent drop is briefly reported. Data obtained from the study of Hg and water drops were used as a basis for this study. (auth)

6763 AERE-Lib/Trans-661

THE ENRICHMENT OF SANDS IN SPIRAL SEPARATORS. K. V. Solomin. Translated by R. D. Lowde from Gornyi Zhur., No. 6, 51-4(1955). 9p.

Results indicate that spiral separators are completely successful for enrichment of sands holding scattered grains of valuable minerals of specific gravity above 4. (auth)

6764 AERE-Lib/Trans-702

INFORMATION ON THE ELECTROLYSIS OF FUSED SALTS. P. Drossbach. Translated by F. Hudswell from Z. Elektrochem. 59, 512-25(1955). 31p.

Investigations are communicated on methods of measuring the polarization voltage. The current efficiencies and polarization voltages are given for the electrolysis of $TiCl_4$ in KCl + LiCl, of $CrCl_2$ and of $CrCl_3$ in KCl + NaCl, and of TiCl in KCl + NaCl. A survey is presented on the measurements of single potentials and overvoltages in fused salts. (auth)

6765

DIFFUSION OF URANIUM THROUGH GRAPHITE. L. D. Loch, J. R. Gambino, and W. H. Duckworth (Battelle Memorial Inst., Columbus, Ohio). A.I.Ch.E. Journal 2, 195-8(1956) June.

Diffusion rates of uranium through graphite were determined in the temperature range of 3,000° to 4,350°F. The diffusion couples consisted of sintered UC_2 disks in contact with graphite rods. The observations indicated two distinct types of uranium transport which could be associated with volume diffusion and with migration along pores respectively. Volume diffusion was characterized by steep concentration gradients and shallow penetration. The diffusion coefficient D_v, in sq.cm./sec. between 3,300° and 4,250°F., is given by an equation. Above 4,250°F. incipient melting of the UC_2 was evident and the diffusion coefficients were much higher than those given by the equation. As an example of the penetration resulting from volume diffusion, calculations show that, after 1,000 hr. at 4,200°F. the uranium concentration at 0.1 cm. from the interface will be 1,000 mg./cc., compared with 10,000 mg./cc. for pure UC_2. Pore migration resulted in uranium penetration far beyond that arising from volume diffusion at equivalent temperatures and diffusion times. However, uranium concentrations were very small compared with those corresponding to volume diffusion. Pore migration is strongly temperature dependent. To estimate the practical importance of pore migration, the uranium flow through a graphite wall at 3,000°F. was measured. With a wall thickness of 0.32 cm., the average flow per unit area was 0.015 mg./(sq.cm.)/(hr.) for a 40-hr. test. (auth)

6766

MASS TRANSFER IN LIQUID METALS. W. E. Dunn, C. F. Bonilla, C. Ferstenberg, and B. Gross (Columbia Univ., New York). A.I.Ch.E. Journal 2, 184-9(1956) June.

The rate of mass transfer was measured for solid metal shapes dissolving into mercury at room temperature. Sherwood numbers for horizontal tin, cadmium, zinc, and lead cylinders dissolving by natural convection agreed with Nusselt numbers for heat transfer in nonmetallic liquids at the same Rayleigh (Grashof × Prandtl) numbers. Dissolving of zinc tubes by mercury flowing turbulently within them agreed with heat transfer to nonmetals in tubes. Dissolving of random beds of lead spheres by mercury flowing through the bed agreed with similar nonmetal systems. It is concluded that mass transfer processes in liquid metals follow substantially the correlations for other fluids in heat or mass transfer, which with moderate safety factors may thus be used for at least preliminary design purposes. (auth)

6767

A SYSTEM FOR COUNTING VARIABLES IN SEPARATION PROCESSES. Mooson Kwauk (Hydrocarbon Research, Inc., New York). A.I.Ch.E. Journal 2, 240-8(1956) June.

In the proposed system for counting variables in separation processes the processes are resolved into their simpler component classes, e.g., theoretical plates, heat exchangers, reboilers, distillation columns, etc., and a distinction is made between those variables which are inherent in the systems and those which may be specified for design. Results are presented for the most commonly occurring component classes, and all possible process relations existing among these classes are expressed by a set of generalized equations. The procedure of counting variables is therefore reduced to composition from variables for the component classes by use of the generalized equations. (auth)

6768

INFLUENCE OF THE POLARIZATION CORRECTION (FERMI-CORRECTION) OF THE ELECTRON STOPPING POWER ON THE DOSE MEASUREMENTS FROM HARD X RAYS. G. Breitling and R. Glocker (Stuttgart Technical Inst., Germany). Naturwissenschaften 42, 483(1955) Sept. (In German)

6769

THE ROTATION OF PLASMAS IN MAGNETIC FIELDS. H. Pupke and H. G. Thom. Naturwissenschaften 43, 32(1956) Jan. (In German)

6770

HALL COEFFICIENT AND THERMOELECTRIC POWER OF THORIUM METAL. Joseph H. Bodine, Jr. (Bartol Research Foundation of the Franklin Inst., Swarthmore, Penna.). Phys. Rev. 102, 1459(1956) June 15.

The Hall coefficient of two samples of thorium metal was measured at room temperature in magnetic fields on the order of 4000 gauss, and an average value of -1.2×10^{-11} volt-cm/abampere gauss obtained. The voltage of a Th–Pt

thermocouple in the temperature range 400°C to 1100°C is also reported. (auth)

6771

ON THE IMAGE CHARACTERISTICS OF A MAGNETIC SECTOR FIELD BY CONSIDERATION OF THE LEAKAGE FIELD. L. A. König and H. Hinterberger (Max Planck Inst. of Chemistry, Mainz, Germany). Z. Naturforsch. 10a, 877-86(1955) Nov. (In German)

6772

TEMPERATURE DEPENDENCE OF THE ISOTOPIC EFFECTS ON PASSAGE OF CURRENT IN MOLTEN INDIUM METAL. Alex Lodding, Arnold Lunden, and Hans von Ubisch. Z. Naturforsch. 11a, 139-42(1956) Feb. (In German)

At various temperatures direct current was conducted through a capillary tube of molten In whereby In^{115} was concentrated on the cathode and In^{113} on the anode. This so-called Haeffner effect showed a distinct functional relationship with temperature. The increase of the mass effect $\mu(10^{-5}$ at 210°; 6×10^{-5} at 820°C) with the temperature was of the theoretical prediction of order of magnitude. (tr-auth)

6773

SPECTROSCOPIC DISTRIBUTION OF THE PHOTOELECTRIC EFFECTS IN LEAD SULFIDE. Horst Ulrich Pfeiffer. Z. Naturforsch. 11a, 164-5(1956) Feb. (In German)

6774

DISTRIBUTION OF ELECTRON DENSITY ON THE ELECTRON-MICROSCOPIC IMAGE. I. G. Stoyanova. Zhur. Tekh. Fiz. 26, 990-5(1956) May. (In Russian)

Studies are made of the distribution of electron density on the electron-microscopic image of homogeneous objects in relation to the atomic weight of the substance, to the quantity of scattering substance, and accelerating intensities. (R.V.J.)

6775

ON THE EFFECTIVE MEAN LENGTH OF A BEAM. V. I. Pukhov. Zhur. Tekh. Nauk 26, 1080-93(1956) May. (In Russian)

A method is offered for determining the effective mean length of a beam and mathematical expressions are given for some particular cases. In the expressions given the effective mean length of a beam depends not only on the shape and dimensions of the emitting volume but, also, on the physical parameters of the emitting media. (tr-auth)

6776

DEVELOPMENTS IN THE FIELD OF PHYSICS IN HUNGARY. Ishtvan Kovach. Vestnik Akad. Nauk S.S.S.R. 26, 52-60(1956) Apr. (In Russian)

A central Research Institute was organized in 1950 and investigations in cosmic radiation and mesons have been initiated. In 1952 a cascade generator of 800 kw for acceleration of heavy particles, and a 1-Mev belt generator for electron acceleration, production of gamma rays, and studies of high-energy electron bremsstrahlung, were built by the Atomic Institute. Another cascade generator of 600 kw and a belt generator of 5 Mev for investigations and isotope production are under construction as well as the equipment for production of heavy water. Wide radiological mining studies are made to determine the content of uranium in coal. Isotopes with short half life from atomic furnaces of the Soviet Union are studied. (R.V.J.)

ASTROPHYSICS

6777 AEC-tr-2487

ON THE ISOTOPES OF METEORITIC ARGON. A. V. Trofimov and K. G. Rik. Translated from Doklady Akad. Nauk S.S.S.R. 102, 911-14(1955). 7p.

Studies were made to determine meteorite ages by the argon method considering the radiogenic A^{40} formed by the decay of K^{40}. Isotopic composition of A separated from several meteorites was investigated to determine its radioactive origin and its nuclear source. Seven meteorites-chondrites with relative high content of A were analyzed and a table of maximum corrections for previous evaluations of age of meteorites is given. (R.V.J.)

COSMIC RADIATION

6778 AEC-tr-2488

ON THE EXISTENCE OF PENETRATING PAIRS. A. V. Khrimyan. Translated by V. Rimsky-Korsakoff from Doklady Akad. Nauk S.S.S.R. 104, 393-6(1955). 11p.

In investigating products of nuclear spallation caused by the neutral component of cosmic radiation, the existence was verified of pairs of opposite charged particles at least one component of which was nuclear inactive. It was found that neutral radiation causes the generation of pairs of charged particles of opposite sign, at least one component of which cannot be either a π meson or a proton and the observed pairs cannot be the products of decay of neutral particles which disintegrate only into nuclear-active particles. (F.S.)

6779 AEC-tr-2491

UNUSUAL V°-DECAY. E. Friedländer and S. Bercea. Translated from Doklady Akad. Nauk S.S.S.R. 107, 51-3 (1956). 3p.

In a systematic investigation of V^0 decays in emulsions irradiated with cosmic rays an unusual V^0 decay was found. The light particle was identified as a pion. The heavier particle was heavier than a proton. Measurements and analysis indicated this was not a new "elementary particle" but the observation was of the mesonic decay of a Λ^0 particle bound to a neutron or the decay of a Λ^0-dineutron. (F.S.)

6780 AERE-Lib/Trans-696

SPATIAL DISTRIBUTION OF CHARGED PARTICLES AT SMALL DISTANCES FROM THE AXIS OF AN EXTENSIVE ATMOSPHERIC SHOWER. O. I. Dovzhenko and S. I. Nikol'skii. Translated by R. C. Murray from Doklady Akad. Nauk S.S.S.R. 102, 241-5(1955). 5p.

A study of the spatial distribution of charged particles at 0.5 to 5 meters from the axes of extensive atmospheric showers is reported. Results prove that a small number of high energy electrons and photons in the showers have spacial density distributions corresponding to the maximum development of electron-photon avalanches, assuming electron-photon components are formed at the observational level through interaction of secondary nuclear-active particles with energies E_s of about 10^{11} to 10^{12} ev in the depth of the atmosphere and that the form of the energy spectrum of the secondary particles in this 10^{11} to 10^{12} ev range does not depend on the energy of the primary nucleus. (F.S.)

6781

ON THE ANALYSIS OF THE SLOW PARTICLES EMITTED FROM COSMIC-RAY STARS. I. Shigeo Nakagawa, Eiji Tamai, Humiaki Huzita, and Kiyoaki Okudaira (Rikkyo (St. Paul's) Univ., Tokyo). J. Phys. Soc. Japan 11, 191-5(1956) Mar.

An analysis of the nature of tracks of the stars ending in G5 emulsions was made by measuring their width (diameter). Six groups of tracks having different width were observed. Two of these groups were identified as that α particles and Li nuclei by comparing their width with those of α particles

emitted from radiothorium stars and with those of hammer tracks. As for the thicker tracks, the charge determination on the tracks of each group was made by measuring their thin-down lengths. These measurements seem to indicate that the width of track was approximately proportional to $\sqrt{Z}$ (Z: atomic number). The energy and the angular distribution of each group were also examined. The curves of the energy distribution of protons and α particles approximately agreed with those deduced from the evaporation model, assuming the appropriate nuclear temperature and Coulomb barrier height. The angular distributions of these were nearly isotropic. It was noted that the number of slower α particles measured seems to be considerably larger than that deduced from theory. (auth)

6782

A STATISTICAL INVESTIGATION FOR THE ATMOSPHERIC TEMPERATURE EFFECT ON COSMIC-RAY INTENSITY. Masami Wada and Shoko Kudo. J. Sci. Research Inst. (Tokyo) 50, 1-9(1956) Mar.

By taking the partial temperature coefficient into account, the atmospheric temperature effect on cosmic-ray intensity at sea level has been investigated statistically. The obtained coefficient corresponding to the temperature variation in the upper atmosphere indicates the existence of positive temperature effect due to the $\pi-\mu$ decay phenomenon. (auth)

6783

COSMIC RAY SHOWERS OF WIDE EXTENT. G. R. Macleod (Cavendish Lab., Cambridge, England). Nuovo cimento (10) 3, 118-25(1956) Jan. (In English)

Extensive air showers have been observed at sea level, using a maximum counter tray separation of 1,200 m, by a method allowing a direct determination of the angular distribution of the shower axes. It is found to be proportional to $(\cos\theta)^{6.5\pm0.5}$. Comparison of the decoherence rates of the showers with nucleon cascade theory predictions, shows that the angular dependence of the nucleon collision cross section which determines the lateral spread of the shower, is very sharply peaked in the forward direction. The shower rates are compatible with the known rates of electron-photon cascades at sea level, if each of these is considered to be associated with a penetrating cascade of much larger spread and lower particle density. The penetrating cascade carries about 1/5-th of the total shower energy, and contains about 1/10-th of the total number of particles in the shower at sea level. (auth)

6784

ON COSMIC RAYS JETS. G. Bertolino (Istituto di Fisica dell'Università, Torino). Nuovo cimento (10) 3, 141-51(1956) Jan. (In English) (cf. NSA 9-1008)

A study was made of 59 jets found in the scanning of nuclear plates exposed to cosmic radiation during the Sardinia Expedition of 1952 and 1953 and measured in the Turin and Padua Sections of the National Institute of Nuclear Physics. Studying the angular distribution of jet-tracks, a substantial and abrupt increase of the angle has been noted at the last tracks, which can be considered as due to secondary phenomena after the primary collision. The primary energy and anelasticity coefficient of jets has been calculated, excluding the tracks considered as due to secondary phenomena: the jets can consequently be divided in two classes having as mean value for the anelasticity coefficients 0.52 and 0.18, respectively. The incongruency, arising from the fact that in previous works values of the anelasticity coefficient greater than 1 have been calculated, has been eliminated. (auth)

6785

THE RATE OF EXTENSIVE SHOWERS OF HIGH ELECTRON DENSITY AT SEA LEVEL. C. B. A. McCusker and B. G. Wilson (Dublin Inst. for Advanced Studies, Ireland). Nuovo cimento (10) 3, 188-94(1956) Jan. (In English)

Extensive air showers of high electron density (average density ~ 700 particles/m^2) have been observed at sea level. The rates of all classes of events with respect to sidereal time are constant within the statistical errors. With respect to solar time however a variation of amplitude ~ 20% and period 12 hours has been found. This variation is out of phase with the previously observed variation of high energy local penetrating showers. Both are correlated with the oscillations of the atmosphere. (auth)

6786

A HIGH ENERGY SHOWER. A. Debenedetti, C. M. Garelli, L. Tallone, M. Vigone, and G. Wataghin (Istituto di Fisica dell'Università, Torin). Nuovo cimento (10) 3, 226-7(1956) Jan. (In English)

A general description is given of a possibly anomalous event. (B.J.H.)

6787

CLOUD CHAMBER STUDY OF COSMIC RAY ELECTRONIC SHOWERS UNDER DENSE MATERIALS. II. G. Di Caporiacco and M. Giovannozzi (Istituto di Fisica dell'Università, Firenze). Nuovo cimento (10) 3, 305-17(1956) Feb. (In English).

Pictures have been taken by means of a counter controlled cloud chamber on electronic showers produced in lead plates 1, 3 and 4 cm thick. The angular distribution of tracks has been compared with the calculations of Roberg and Nordheim and of Franchetti and Giovannozzi. The distribution of showers as a function of the number of electrons has been used to check the results given by Janossy and Messel and by Arley. (auth)

6788

INTERGALACTIC SPACE AND COSMIC RAYS. G. Cocconi (Istituto di Fisica dell'Universita, Bologna). Nuovo cimento (10) 3, 1433-42(1956) June.

It is suggested that the most energetic particles observed in cosmic radiation are accelerated outside the galaxy in the intergalactic space. Possible space models are presented. (auth)

6789

AN UNUSUAL DOUBLE V-EVENT AT SEA LEVEL. J. L. Lloyd and A. W. Wolfendale (Univ. of Manchester, England). Phil. Mag. (8) 1, 93-6(1956) Jan.

A double V event from a single incident particle was recorded by cloud chamber photographs. The nature of this event is discussed. (D.E.B.)

6790

THE INTERACTIONS OF COSMIC RAY ALPHA-PARTICLES. C. J. Waddington (Univ. of Bristol, England). Phil. Mag. (8) 1, 105-8(1956) Jan.

Results of a study of the nuclear interactions produced by α particles of the primary cosmic radiation are described. These particles were recorded in various stacks of stripped and glass-backed nuclear emulsions exposed at balloon altitudes. Most of the disintegrations were observed in a stack of stripped emulsions exposed in such conditions that few of the incident α particles had energies less than 0.5 Bev/nucleon; the median energy of all the α particles considered was approximately 1.3 Bev per nucleon. (auth)

6791

DISINTEGRATION OF HYPERFRAGMENTS. II. W. F. Fry, J. Schneps, and M. S. Swami (Univ. of Wisconsin, Madison). Phys. Rev. 101, 1526-35(1956) Mar. 1.

The systematic study of hyperfragments has been continued. A total of 32,000 cosmic-ray stars, 10,000 6-Bev proton stars, 32 000 3-Bev π^- -meson stars and 206 stars produced by stopped negative K mesons were examined. Twenty hyperfragments were found in the cosmic-ray plates, 7 in the

proton plates, 30 in the π^--meson plates and 11 in the negative K-meson plates. The average charge of the hyperfragments is between 4 and 5. The average range of the hyperfragments is about 10 microns. Including previous data from this laboratory, only 2 mesonic decays have been found out of 98 events with Z greater than 2. A total of 7 helium hyperfragments have been observed of which 4 decayed mesonically. Of 4 hydrogen hyperfragments, all decayed with the emission of a π^- meson. In the following eight cases, it was possible to measure the total energy release in the hyperfragment disintegration, and hence to find the following values (in Mev) for the binding energy of the Λ^0 particle: ${}_\Lambda H^3 (B_\Lambda = 0.6 \pm 0.6)$; ${}_\Lambda H^3 (B_\Lambda = -0.5 \pm 0.6)$; ${}_\Lambda H^3 (B_\Lambda = 0.4 \pm 0.7)$; ${}_\Lambda H^4 (B_\Lambda = 0.5 \pm 2.0 \text{ or } 1.9 \pm 2.0)$; ${}_\Lambda He^4 (B_\Lambda = 0.0 \pm 2.0)$; ${}_\Lambda He^4 (B_\Lambda = 1.8 \pm 0.6)$; ${}_\Lambda He^5 (B_\Lambda = 2.0 \pm 0.6)$; ${}_\Lambda Be^9 (B_\Lambda = 6.5 \pm 0.6)$. The binding energies tend to increase with increasing mass number. The fact that ${}_\Lambda H^4$ and ${}_\Lambda He^5$ hyperfragments exist, plus the fact that the binding energy of the Λ^0 particle in ${}_\Lambda Be^9$ is greater than that of the last neutron in Be^9, shows that the Pauli principle need not be considered for a Λ^0 particle bound in a nucleus. If the binding of the Λ^0 particle can be described in terms of a potential well the depth of the well is greater than 6.5 Mev, as indicated by B_Λ for ${}_\Lambda Be^9$. In light hyperfragments the low binding energies imply that the Λ^0 particle spends much of its time outside the nucleus. The momentum of the Λ^0 particle has been measured in several light hyperfragments where a π^- meson and proton were emitted, by assuming it to be equal to the momentum of the π^- meson and proton. In general the momentum values are quite low, which supports the hypothesis that the bound Λ^0 particle spends considerable time outside the nucleus. No further examples of energetic hyperfragments, as have been previously reported, were found in this work. (auth)

6792

EFFECTIVE GEOMAGNETIC EQUATOR FOR COSMIC RADIATION. J. A. Simpson and K. B. Fenton (Enrico Fermi Inst. for Nuclear Studies, Chicago) and J. Katzman and D. C. Rose (National Research Council, Ottawa, Canada). Phys. Rev. 102, 1648-53(1956) June 15.

The distribution of the geomagnetic field extending far from the surface of the earth is investigated by using cosmic-ray particles as probes. Since for any longitude the cosmic-ray intensity reaches a minimum at the effective geomagnetic equator of this outer field, a series of determinations of the minimum intensity at several longitudes defines its effective equatorial plane. Measurements using the neutron intensity from the nucleonic component prove that large discrepancies exist between experimental observations and the presently accepted geomagnetic coordinates derived from surface magnetic field measurements. It is also found that meson intensity data from the past 20 years or more may be used to determine minima at other longitudes. The results indicate that the effective geomagnetic equator for cosmic rays is simulated by a westward shift of the inclined magnetic dipole of the earth by about 40 to 45°, without requiring an appreciable change in the angle of inclination. Several anomalous results which have been reported at intermediate and equatorial latitudes for primary alpha particles and heavy stripped nuclei detected in photoemulsions are readily explained by this shift in coordinates, supporting the view that the discrepancies are world-wide in character. Since the surface magnetic field measurements do not account for this large-scale effect, it is suggested that the explanation may be found from the interaction of the rotating and inclined magnetic dipole field with a highly ionized interplanetary medium. (auth)

6793

UNUSUAL SURGE OF COSMIC RAY INTENSITIES. L. I. Dorman (Research Inst. of Earth Magnetism, Ionosphere and Distribution of Radiowaves). Priroda 45, 85-7(1956) June. (In Russian)

An unusual surge of cosmic-ray intensity was observed Feb. 23, 1956. The scale showing the distribution of the cosmic-ray intensities indicate stronger concentration of intensities at higher latitudes (Moscow) and considerable lowering of intensities at the lower latitudes (Japan). The observed surge was 5 to 10 times stronger than the ones observed in 1942 or 1946. The surge of cosmic rays was combined with powerful chromospheric sun eruption and interrupted all short wave radio communications. It is assumed that the eruption took place on the northwest tip of the sun where a great deal of activity, large number of spots, and chromospheric eruptions were observed before and after the event. (R.V.J.)

6794

POSITIVE TEMPERATURE EFFECT OF COSMIC RAYS. Satio Hayakawa, Kensai Ito, and Yoshinosuke Terashima (Kyoto Univ., Japan). Progr. Teoret. Phys. (Japan) 14, 497-510(1955) Dec.

The temperature effect on the intensity of μ-emsons at sea-level is investigated by taking π-μ decays into account. The positive temperature coefficient is calculated by analysis of the difference in the attenuation mean free path of the N-component and the absorption mean free path of π mesons and the atmospheric depth. The magnitude of the coefficient is obtained as 0.05%/°C and the depth of main contributions is found to be 200 mb. Influence of heavy mesons is qualitatively discussed. (auth)

6795

INTERACTIONS OF PRIMARY COSMIC PARTICLES OF VARIOUS ENERGIES (2 to 1000 Bev) WITH LIGHT ATOMIC NUCLEI. N. L. Grigorov. Uspekhi Fiz. Nauk 58, 599-666(1956) Apr. (In Russian)

Analyses of studies show that with cosmic particles of several Bev the primary particle is absorbed in the process of π-meson formation and in nuclear fissions. The loss of energy and complete absorption depend upon the energy of the primary particles; $E_0 = 3$ Bev lose $53 \pm 5\%$ of their energy on formation of heavy particles in nuclear fission; $E_0 = 200$ Bev lose only $15 \pm 2\%$. The energy losses in π-meson formation are for primary particles of 3 Bev = $45 \pm 3\%$ and for 20 Bev = $84 \pm 2\%$. The process of π-meson formation is multiple. In the first collision with the light nucleus the primary particle transmits to the π meson only a small part of its energy (3 Bev = 21%, 20 to 40 Bev = 28 to 30%; 100 to 1000 Bev = 30% or less than 50%), the remaining energy is absorbed by a nucleon. For particles of 10^{11} to 10^{12} ev the retained energy (of 70% of primary energy) also is absorbed by nucleons. During fission of light nuclei the particles of high energies (3 to 40 Bev) use $\epsilon = 440 \pm 160$ Mev; these energies remain independent from the energy of the incoming nucleon. Approximately 200 Mev are transmitted to the charged heavy particle and the remaining energy of ~200 Mev is absorbed by an average 2.8 ± 0.4 neutrons. Experimental observations of the characteristics of the interaction processes of light nuclei with particles of high energy may be used to describe quantitatively the path of cosmic-ray nucleon components through the atmosphere. (R.V.J.)

6796

THE ABSORPTION OF NEUTRON-PRODUCING COMPONENTS OF COSMIC RADIATION IN LEAD AND ALUMINUM. H. Reich. Z. Naturforsch. 10a, 914-19(1955) Dec. (In German)

6797

HEAVY UNSTABLE PARTICLES FROM THE COSMIC RADIATION. K. Gottstein, B. Roederrer, J. Roederrer,

N. Varshneya, and P. Waloschek. Z. Naturforsch. 11a, 152-6(1956) Feb. (In German)

The experimental data are given of 2 τ^+ mesons, 3 excited fragments (one of which decays in flight), 1 capture of a K-meson resulting in the emission of a fast particle, and 4 $K_{\mu 2}$ particles (one of which produced in association with a negative hyperon). (auth)

Refer also to abstracts 6866 and 7035.

CRYSTALLOGRAPHY AND CRYSTAL STRUCTURE

6798 AERE-C/R-1809

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A TECHNIQUE FOR MOUNTING VERY SMALL SINGLE CRYSTALS FOR X-RAY INVESTIGATIONS. E. Wait. Dec. 8, 1955. 6p.

A simple micromanipulator technique is described for mounting single crystals of dimensions in the range 5 to 50 microns for x-ray-diffraction investigation. A method for maintaining crystals in a controlled atmosphere is also described and ways in which the technique could be adapted to active operations are briefly indicated. (auth)

6799 AERE-Lib/Trans-658

A METHOD OF GROWING SINGLE CRYSTALS OF METALS WITH PRESCRIBED SPATIAL ORIENTATION AND NATURAL CRYSTALLOGRAPHIC FACES. D. M. Chigvinadze. Translated by R. C. Murray from Zhur. Tekh. Fiz. 25, 805-11(1955). 9p.

The experimental results indicate that the orientation of the crystals depends very much on the direction of heat transfer. In particular, the basal plane of the zinc monocrystal was always parallel to the direction of convective flow of air around the protective tube. Changing the direction of the temperature gradient, the form of the small tube, and its position with respect to the axis of the protective tube, gives complete control over the growth of the monocrystal and enables one to obtain crystals of any desired spatial orientation. (auth)

6800

X-RAY AND NEUTRON DIFFRACTION STUDY OF FERROELECTRIC $PbTiO_3$. Gen Shirane and Ray Pepinsky (Pennsylvania State Univ., University Park) and B. C. Frazer (Brookhaven National Lab., Upton, N. Y.). Acta Cryst. 9, 131-40(1956) Feb.

X-ray single-crystal and neutron powder diffraction analyses of tetragonal $PbTiO_3$ at room temperature reveal the following coordinate shifts of the Ti and O atoms from perovskite positions, with Pb taken at the origin of the pseudo-perovskite cell: $\delta z_{Ti} = +0{\cdot}040$, $\delta z_{OI} = +0{\cdot}112$, δz_{OII} $+0{\cdot}112$. The equivalence of δz_{OI} and δz_{OII} suggests that the oxygen octahedra may be considered as 'fixed' in the lattice as the crystal passes from the cubic paraelectric phase above 490°C. to the tetragonal ferroelectric structure which it maintains below this temperature. With the oxygens defining the cell, the Pb ions are shifted by +0.47 A along the z axis, and the Ti ions move in the same direction by 0·30 A. (auth)

6801

AN EXPLANATION OF THE STRUCTURES OF HEXAGONAL BARIUM TITANATE AND TITANIUM DIOXIDE. P. Vousden (Cavendish Lab., Cambridge, England). Acta Cryst. 9, 141-2(1956) Feb.

The structure of hexagonal barium titanate is explained in terms of the semipolar nature of the Ti–O bond, and the Ti–O and Ba–O bond distances. The brookite and anatase forms of TiO_2 are explained by bond-angle considerations. (auth)

6802

A NEW RATIONALE OF STRUCTURE-FACTOR MEASUREMENT IN NEUTRON-DIFFRACTION ANALYSIS. R. D. Lowde (Atomic Energy Research Establishment, Harwell, Berks, England). Acta Cryst. 9, 151-5(1956) Feb.

The Laue method of recording integrated intensities, with certain adjuncts, appears to be in many ways simpler than the rotating-crystal method for single-crystal neutron diffraction analysis, at the same time as offering increased intensities. A proposed technique is discussed, which is particularly suitable for use with pulsed neutron sources such as electron accelerators. (auth)

6803

COMPOUNDS WITH THE α-U_3-O_8-TYPE STRUCTURE. William T. Holser (Battelle Memorial Inst., Columbus, Ohio). Acta Cryst. 9, 196(1956) Feb.

X-ray diffraction patterns of γ-Nb_2O_5, β-Ta_2O_5, and α-U_3O_8 confirmed the existence of orthorhombic pseudo-hexagonal unit cells in these compounds. (C.W.H.)

6804

IRRADIATION-INDUCED PHASE TRANSFORMATION IN ZIRCONIA. M. C. Wittels and F. A. Sherrill (Oak Ridge National Lab., Tenn.). J. Appl. Phys. 27, 643-4(1956) June.

As a result of fast neutron bombardment, monoclinic ZrO_2 is transformed into the cubic phase normally stable only above 1900°C. It is suggested that the unique temperature-structure behavior in the zirconia system lends itself to this transition in a manner whereby two possible mechanisms may be operative. Stresses acting about trapped interstitial atoms and thermal spike effects are presented as the possible mechanisms. (auth)

6805

ORIENTED OVERGROWTH OF EVAPORATED CRYSTALLITES. FLUORIDE CRYSTALLITES ON CLEAVAGE SURFACES OF SINGLE CRYSTALS. Jiro Shigeta (Okayama Univ., Japan). J. Phys. Soc. Japan 11, 206-10(1956) Mar.

The orientation of crystallites in fluoride films (LiF, NaF, CaF_2, MgF_2, AlF_3 and Na_3AlF_6) evaporated in vacuum onto the cleavage surfaces of several kinds of single crystals (galena, rocksalt, molybdenite and zinc-blende) were investigated by means of electron diffraction. The oriented overgrowth occurs even when the misfit is larger than 20%; for LiF and NaF on the galena misfits are −33% and −23% respectively, for LiF on rocksalt the misfit is −20% and for CaF_2 on molybdenite +23%. On the other hand, for CaF_2 on rocksalt the random orientation occurs though the misfit is only −3%. Therefore, the occurrence of orientation can not be predicted solely by the value of misfit. It is worth mentioning that in the present experiment no twin was observed provided the evaporated layer is thin, as previously stated. This excludes the mechanism of oriented overgrowth which was proposed by Menzer. (auth)

ELECTRICAL DISCHARGE

6806 AERE-Lib/Trans-686

THE FORMATION OF PLASMA UNDER THE ACTION OF AN ELECTRICAL IMPULSE. G. V. Spivak and E. L. Stolyarova. Translated by P. Collins from Zhur. Tekh. Fiz. 20, 501-15(1950). 22p.

With the assistance of an oscillograph with a delayed timebase, a display of the production of plasma under the influence of a single impulse in the breakdown of a long discharge gap at low pressure was produced. The influence of the field of a magnetic lens, shielded with iron, on the time and character of the formation of plasma was investigated. It was established that the magnetic field reduces both the statistical time-lag and the true formative lag of the establishment of plasma. The magnetic field affects the

two distinct phases of the establishment of plasma in different ways. Initially, the magnetic field increases the electron-optical effect and then causes the positive space charge to develop more quickly. The mechanism of the formation of plasma under the normal conditions, without the magnetic lens, is discussed in detail. Attention is first of all turned to the exceptional importance of the sharply directed movement of the electrons in the mechanism of the first phase of the breakdown in both long and short gaps. It is further shown that the breakdown passes through a phase of a gas-focused beam, and that the initial formation of an electron optical field, which acts as the essential guiding field, is necessary for the commencement of plasma formation. Normal plasma is formed in two phases: electron-optical and a true plasma. The latter is characterized by the degeneration of the directed movement of electrons into random movement. The formative time was determined. The mechanism which leads to the delay in the production of the second phase is explained and also the nature of the transition processes from the first to the second phase. (auth)

6807

RUSSIAN THERMONUCLEAR EXPERIMENTS (WHAT KURCHATOV SAID AT HARWELL). Nucleonics 14, No. 6, 36-43 & 123(1956) June.

Extensive experiments with high-temperature discharges in deuterium gas as an approach to thermonuclear power were reported. Neutrons and x rays were produced but it is felt that the stationary process has fewer limitations. (F.S.)

ELECTRONS

6808 NYO-7237

Providence Coll., R. I.

THE STUDY OF GASEOUS NEGATIVE IONS FORMED BY ELECTRON IMPACT. Period Covered: August 20, 1954 to November 19, 1955. Morton A. Fineman and George F. Martins. Nov. 19, 1955. 40p. Contract AT(30-1)-1670. $0.30(OTS).

A classification of the types of reactions which may occur on electron impact is given. A description of the kind of information and how it is obtained with the Tate-Lozier apparatus follows. It is then shown how one can identify each new appearance potential of an ion to the reaction in which it is initiated. Thermochemical data such as bond dissociation energies, ionization potentials, electron affinities and heats of formation may be determined with a Tate-Lozier apparatus. How one or more of these quantities may be obtained from electron impact studies for a single gas is described. The design and construction of the various components of the Tate-Lozier apparatus are described. Although the apparatus is now assembled, there still remain a few preliminary tests to be performed before any studies can be made. (auth)

6809

ON THE ANNIHILATION OF POSITRONS IN CONDENSED MATERIALS. T. R. Gerholm. Arkiv Fysik 10, No. 6, 523-52(1956).

The positron annihilation lifetimes in various metals and insulators have been measured with automatic mμsec coincidence equipment. The lifetimes were found to be the same in all metals and equal to $(2.5 \pm 0.3) \times 10^{-10}$ sec, which is longer than the value hitherto accepted, $(1.5 \pm 0.3) \times 10^{-10}$ sec. The halflife of the first excited state in Pb^{207} was found to be $(0.9 \pm 0.3) \times 10^{-10}$ sec. This result is in accordance with the value $1.0^{+0.4}_{-0.2} \times 10^{-10}$ sec deduced for this halflife from the reduced transition probabilities measured in Coulomb excitation. The annihilation lifetimes in various metals and insulators are in agreement with the theoretical values deduced from a model suggested here. A weak component with a longer lifetime has been observed in Al. An interpretation of this component is suggested, based on the same model. (auth)

6810

GROWING ELECTRIC SPACE-CHARGE WAVES. J. H. Piddington (C.S.I.R.O., Sydney, Australia). Australian J. Phys. 9, 31-43(1956) Mar.

The theory of growing space-charge electric waves was thought to explain the operation of the electronwave tube, other amplifying devices, and solar radio emission. The theory was shown to be untenable, the predicted growth being spurious and due to misinterpretation of the dispersion equations. An alternating theory of operation of the electronwave and other growing wave tubes was given and design factors are briefly discussed. (F.S.)

6811

FORMULAE FOR THE MEAN LOSSES OF ENERGY IN COLLISIONS OF SLOW ELECTRONS MOVING IN DIATOMIC GASES. L. G. H. Huxley (Univ. of Adelaide, Australia). Australian J. Phys. 9, 44-53(1956) Mar.

Formulas are derived for the mean losses of energy in collisions with molecules by electrons moving in a steady state of motion in a diatomic gas in an electric field. Although the theory is incomplete and crude, yet the formulas describe the experimental measurements closely in the smaller ranges of electronic energy. Such formulas find application in the theory of radio wave interaction. (auth)

6812

THE SCATTERING OF 121 KEV ELECTRONS AND POSITRONS. L. J. Tassie (Univ. of Melbourne, Australia). Australian J. Phys. 9, 54-60(1956) Mar.

The angular distribution of the single scattering of 121-kev positrons in gold and of 121-kev electrons and positrons in argon is calculated for an exponentially screened field. The single scattering distributions are integrated numerically to give mean square angles of multiple scattering, and hence the percentage difference in the rms angles of multiple scattering of electrons and positrons. (auth)

6813

ON THE EFFECT OF QUANTUM FLUCTUATIONS IN ELECTRON EMISSION ON THEIR MOTION IN A MAGNETIC PERIODIC SYSTEM. A. A. Kolomenskiĭ (Lebedev Inst. of Physics). Doklady Akad. Nauk S.S.S.R. 107, 398-401(1956) Mar. 21. (In Russian)

The motion of relativistic electrons in a magnetic field followed by a specific electromagnetic emission may be considered on the basis of the classical theory. In some singular cases the effects of quantum-type emission on the behavior of the electron trajectory should be considered. Such cases were investigated previously, using Dirac equations for the electron moving in an axially symmetric magnetic field and a wide radius of fluctuation was revealed. However, the strong attenuation in accelerators limits any extensive fluctuations, thus, the theory of wide radius fluctuation cannot be substantiated. Investigations are made of the unique phenomena occurring as a result of the radiation effect on the electron motion in magnetic periodic systems used in accelerators with strong focusing. These phenomena should be considered in work analysis of accelerators of large energies. (R.V.J.)

6814

OBSERVATIONS ON ELECTROMAGNETIC CASCADES IN NUCLEAR EMULSIONS. K. Pinkau (Univ. of Bristol, England). Nuovo cimento (10) 3, 1285-1315(1956) June.

Four cascades, each initiated by a single photon, have been studied in detail. Target diagrams are made at different depths and the energy of every particle plotted

has been determined by multiple scattering measurements. The results are compared with shower theory for lateral and longitudinal development. The theory is found to give a consistent picture within the fluctuation possibilities up to a primary energy of 10^6 Mev. The distribution of particles very near the core is consistent with a law like r^{s-2}. (auth)

6815

MULTIPLE SCATTERING OF ELECTRONS AND POSITRONS IN NUCLEAR EMULSIONS. F. F. Heymann and W. F. Williams (Univ. Coll., London). Phil. Mag. (8) 1, 212-20 (1956) Feb.

Six plates were exposed to nearly monoenergetic electrons and positrons obtained from radioactive sources, and the angular distribution of the resultant tracks was observed. It was found that the angular distribution was approximately Gaussian. Experimental and theoretical values of the scattering constant are tabulated. (B.J.H.)

6816

NATURAL ORBITALS IN THE QUANTUM THEORY OF TWO-ELECTRON SYSTEMS. Per-Olov Löwdin (Uppsala Univ., Sweden) and Harrison Shull (Iowa State Coll., Ames). Phys. Rev. 101, 1730-9(1956) Mar. 15.

The wave functions for the singlet and triplet states of a two-electron system in a given nuclear framework are investigated as superpositions of configurations and are shown to be transformationally equivalent to quadratic forms having certain ranks and signatures. By introducing the "natural orbitals" diagonalizing the generalized first-order density matrix, the total wave functions may also be brought to principal form. If the basis contains M one-electron functions, the singlet and triplet wave functions contain respectively $M(M+1)/2$ and $M(M-1)/2$ configurations, but the transformation to natural orbitals reduces the number of terms to M and $[M/2]$, respectively. The natural expansion having the best convergence is also characterized by another important extremum property. The approximate wave function of rank r having the smallest quadratic deviation from the exact eigenfunction is obtained by interrupting the natural expansion of the eigenfunction after r terms and renormalizing the results. For the singlet state, the wave function of rank two and signature zero has a special importance as giving a simple extension of the visual one-electron picture to include a large part of the correlation effects. The theory is illustrated by some results on He obtained by using radial configuration interaction. (auth)

6817

PAIR PRODUCTION IN THE FIELD OF ORBITAL ELECTRONS BY A TOTAL-ABSORPTION METHOD AT 319 MEV. John D. Anderson, Robert W. Kenney, Charles A. McDonald, Jr. and Richard F. Post (Univ. of California, Berkeley). Phys. Rev. 102, 1632-6(1956) June 15.

The attenuation of (319 ± 4)-Mev photons in liquid hydrocarbons has been measured and has been used to infer the cross section for pair production in the field of the orbital electrons (triplet production). Targets of benzene (C_6H_6) and cyclohexane (C_6H_{12}) were used in good geometry. A pair spectrometer with three fast counter channels was used to measure the intensity of the transmitted photon beam. The synchrotron was monitored with a modified pair spectrometer that was sensitive only to the bremsstrahlung spectrum above 300 Mev. The total absorption cross sections in H and C at 319 Mev have been found to be 18.0 ± 1.8 mb per H atom, and 321.1 ± 2.8 mb per C atom, respectively. Subtraction of the theoretical nuclear pair and electron Compton cross sections and the experimental photomeson cross sections in H from the total H absorption cross section gives 6.8 ± 1.8 mb for the experimental triplet cross section, as compared with the theoretical value of 7.68 mb. Similarly, when one subtracts the cross sections for competing processes in C, one gets for the triplet cross section at 319 Mev the value 46.6 ± 6.4 mb, compared with the theoretical value of 44.4 mb. The large uncertainty in the C triplet cross section is due to uncertainties in the cross sections for the competing processes. (auth)

6818

THE ELECTRON EMISSION OF COLD METAL SURFACES BY MEDIUM FIELD INTENSITIES (~10^4 V/cm). Karl Kerner. Z. angew. Phys. 8, 1-8(1956) Jan. (In German)

GASES

6819 NACA-TN-3271

National Bureau of Standards, Washington, D. C.

THERMODYNAMIC PROPERTIES OF GASEOUS NITROGEN. Harold W. Woolley. Jan. 3, 1955. 114p.

The NBS-NACA tables of thermal properties of gaseous nitrogen are grouped together in this report for convenient use. They include the thermodynamic functions for the gas, both real and ideal, the transport properties for the gas, and the vapor pressure of the liquid and the solid. The tables are in dimensionless form and conversion factors to frequently used units are given. Deviation plots or tables indicating the agreement or discordance of the experimental data are included. (auth)

6820 NRL-4775

Naval Research Lab., Washington, D. C.

ELECTROLYTIC GENERATION OF OXYGEN WITHOUT THE ACCOMPANYING GENERATION OF HYDROGEN. G. W. Work. May 31, 1956. 10p. Project Nos. NR 605-020 and NS 677-100.

A new type of electrolytic gas generator has been developed from a standard, commercial nickel-cadmium alkaline battery by replacing the nickel-oxide plates with sheet nickel ones. Since the cadmium plates do not gas during most of a charge or discharge and the inert plates gas continuously, a single gas is produced in a cell at any time. This unit is particularly suitable as an oxygen generator for a nuclear-powered submarine since both water and electrical energy are readily available. Battery-type construction gives favorable weight and volume considerations plus an unusual design flexibility which would permit building an operating unit with a minimum of cost and development time. Data on several cycles of such a generator are shown and discussed. (auth)

6821 AERE-Lib/Trans-687

THERMAL EFFECTS IN RESONANCE TUBES. [PART] I. H. Sprenger. Translated by F. Hudswell from Mitt. Inst. Aerodynamik, No. 21, 18-34(1954). 20p.

An expanding gas can be split into heated and cooled partial gaseous streams. A demonstration and detailed consideration of this separation in resonance tubes is given. An observed rotary motion of the gas is suggested as an explanation of thermal separation. (D.E.B.)

6822

INVESTIGATIONS WITH LUMINESCENCE PROBES IN 500 TO 1200 A REGION. F. A. Butaeva and V. A. Fabrikant (All Union Research Inst. of Illumination.). Zhur. Tekh. Fiz. 26, 749-54(1956) Apr. (In Russian)

Luminescence probes were used in investigations of resonance emission discharge in inert gases. Inert gas resonance emission lies within the range of the short-wave ultraviolet of helium—584 A; neon—736, 746 A; argon—1048 A; and krypton—1165, 1235 A. Parallel optical measurements and measurements of electron plasma parameters were taken with luminescence probes. (R.V.J.)

Refer also to abstract 6808.

INSTRUMENTS

6823 AD-73304

Massachusetts Inst. of Tech., Cambridge. Servomechanisms Lab.

AN ELECTRO-MECHANICAL READER FOR OSCILLOGRAPH DATA. Technical Memorandum No. 9. John L. Preston. June 1, 1953. 19p. Contract NOrd-11799.

Design features are described for a data reader constructed to mechanize the conversion of data recorded as a trace on oscillograph film to numerical form. The device was used to sample data at discrete time intervals, to correct for variations in transducer excitation, and to convert the trace deflections to numerical values. The data reader reduces the time required to convert the data by at least one half. (C.H.)

6824 DP-135

Du Pont de Nemours (E. I.) and Co. Savannah River Lab., Augusta, Ga.

A TRAMP-METAL DETECTOR. M. H. Goosey. Oct. 1955. 12p. Contract AT(07-2)-1. $0.15(OTS).

An instrument is described which detects small pieces of "tramp" iron in Al alloys. Iron-particle volumes of 3×10^{-4} in.^{3} can be readily detected inside an Al alloy 1 inch in diameter. (auth)

6825 IDO-14370

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

AN INSTRUMENT FOR CONTROLLED POTENTIAL ELECTROLYSIS AND PRECISION COULOMETRIC INTEGRATION. Glenn L. Booman. May 3, 1956. 15p. Contract AT(10-1)-205. $0.15(OTS).

Control of electrolysis potential within 3 mv and response to changes occurring as fast as 10 μsec is attained with a 600-ma capacity potentiostat circuit. A standard deviation of less than 0.05% for integration of electrolysis currents is possible over the range from sub-microgram up through gram-size samples. The instrument is easily constructed and is adaptable to many different types of electro-analytical methods. (auth)

6826 IDO-16169

Phillips Petroleum Co. Atomic Energy Div., Idaho Falls, Idaho.

INTERLOCK CONTROL SYSTEM FOR MTR FAST CHOPPER. R. J. Preston. Jan. 24, 1955. 29p. Contract AT(10-1)-205. $0.25(OTS).

The interlock control system was designed for the MTR Fast Chopper to protect personnel and equipment from radiation and mechanical hazards caused by equipment malfunction. Control is exercised by a series of relays, contactors, and Simplytrol meters which channel power to various units and components associated with the chopper. Interlock bypass switches and panel lamps indicating interlock conditions are incorporated in the unit. Collimator gas-water, steel radiation door, armature current, light pulse, bearing temperature, vacuum, rotor speed, and field current are monitored by the interlock system. (auth)

6827 KAPL-1528

Knolls Atomic Power Lab., Schenectady, N. Y.

AN ELECTRONIC TRIP SYSTEM FOR REACTOR PROTECTION—MODEL D. E. J. Wade and D. S. Davidson. Jan. 17, 1956. 31p. Contract W-31-109-Eng-52. $0.30 (OTS).

A high-speed electronic trip system for use on critical assemblies at the Knolls Atomic Power Laboratory, Schenectady, New York is described. Up to ten safety rods can be released in less than five milliseconds from any one of five trip signal sources. It is believed that this trip system represents a definite advancement over Model B since all critical adjustments have been eliminated. This advancement, combined with the omission of a number of vacuum tubes and components, should greatly reduce the servicing required and increase the reliability of operation. In addition, the certainty of tripping when an input signal is applied has been increased, and the probability of false scrams has been reduced because of the simplification of the circuit. (auth)

6828 NP-5994

Massachusetts Inst. of Tech., Cambridge. Digital Computer Lab.

A MAGNETIC MATRIX SWITCH AND ITS INCORPORATION INTO A COINCIDENT-CURRENT MEMORY (thesis). Kenneth H. Olsen. May 15, 1952. 102p. (R-211).

A multi-position switch, capable of handling pulses shorter than one microsecond, can be made from magnetic cores. Windings on the magnetic cores, when matrix-connected, control selection of the switch output. These windings can be excited with either direct current or pulses. This switch is capable of transmitting power efficiently, and the magnetic cores from which it is made are inexpensive and rugged, and promise reliability and long life. Two such switches pulse the 16 coordinate rows and the 16 coordinate columns of a coincident-current magnetic-core memory. The complete cycle-time of the memory, including the switch set-up time, reading of information, and re-writing of information, is less than 4 microseconds. Design of the magnetic-matrix switch is facilitated by an equivalent-circuit technique. (auth)

6829 UCRL-3357

California. Univ., Berkeley. Radiation Lab.

APPLICATION OF A STATISTICAL CORRELATION FUNCTION FOR DETERMINING DAUGHTER HALF LIVES IN THE RANGE 10^{-4} TO 10^{-1} SECOND. Michael D. Petroff and Wesley O. Doggett. Mar. 31, 1956. 21p. Contract W-7405-eng-28. $0.25(OTS).

Discussed herein is the application of a statistical correlation method to the determination of the lifetime of an activity in equilibrium with a long-lived parent activity. It is shown that this method has a definite advantage over delayed-coincidence methods when the lifetime to be measured is of the order of 10^{-4} second or longer. An electronic apparatus designed to perform the operations required by the statistical correlation method is described. This equipment has been used for a new determination, $0.293 \times 0.020 \times 10^{-3}$ second, for the half life of Y^{88}. (auth)

6830 AD-33170

A CONTRIBUTION TO THE METHODOLOGY OF ATMOSPHERIC-ELECTRIC POTENTIAL MEASUREMENTS. EFFECT OF THE WIND IN RADIOACTIVE COLLECTORS. (Zur Methodik der Luftelektrischen Potentialmessungen. Einfluss des Windes bei Radioaktiven Kollektoren). R. Mühleisen. Translated by Evro Layton from Z. Naturforsch. 6a, 667-71(1951). 15p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 6-3417.

6831 AERE-Lib/Trans-618

MULTIPLE HYDROCYCLONES OF THE LATEST TYPE. H. Trawinski. Translated by J. B. Sykes from Chem.-Ing.-Tech., 27, No. 4 (Suppl.). 5p.

Hydrocyclones of diameter 10 and 15 mm. have been developed in which 36 and 24 individual cyclones, respectively, are combined to form a complete block. It is thus possible to decrease the separated grain size limit to about 3 μ. Information is given about results of operation and fields of application. (auth)

6832
EVAPORATOR FEEDER. W. O. Phillips (Goodyear Atomic Corp., Portsmouth, Ohio). Anal. Chem. 28, 280(1956) Feb.

An automatically controlled evaporator feeder, for use in analytical and spectro chemistry, to evaporate solutions to dryness for examination of residues is described. (J.E.D.)

6833
A CALORIMETER FOR MEASURING THE POWER IN A HIGH-ENERGY X-RAY BEAM. John McElhinney, Bernard Zendle, and Steve Domen. J. Research Natl. Bur. Standards 56, 9-16(1956) Jan.

The design and calibration of a calorimeter to measure the power in x-ray beams having peak energies between 1 and 180 Mev are described. The calorimeter included two thermally balanced lead cylinders, 4 cm. in diameter by 7.5 cm long, one irradiated by an x-ray beam. The lead cylinder was large enough to absorb almost completely the x-ray beam. The absorbed energy resulted in an unbalance of temperature of the two cylinders, which was measured by the change in resistance of embedded thermistors. Calibration of the calorimeter consisted in observing the temperature rise due to a measured quantity of electric energy dissipated in the same cylinder. The results are given for five calibration runs, each using about 70 μw of power for approximately 20 minutes. The probable error of the mean was about ±1%. Separate reports of measurements of x-ray-beam powers at 1.4 and 36 Mev are in preparation. (auth)

6834
THE TEMPERATURE CALIBRATION OF A HIGH TEMPERATURE X-RAY DIFFRACTION CAMERA. J. A. Brand and H. J. Goldschmidt (B.S.A. Group Research Centre, Sheffield, England). J. Sci. Instr. 33, 41-5(1956) Feb.

The accurate measurement, by a thermocouple, of the temperature of fiber specimens in an x-ray high-temperature camera, of the type containing a spherical furnace enclosure, is investigated. Factors affecting the calibration of the thermocouple are discussed, and it is shown experimentally that the chief cause of discrepancies is the abstraction of heat along the thermocouple wires. Methods for calibrating the thermocouple in position, and for reducing the correction required to a minimum, are presented. (auth)

6835
A CELL FOR KINETIC MEASUREMENTS OF GAS EVOLUTION FROM SYSTEMS IRRADIATED BY FAST ELECTRON BEAMS. C. B. Amphlett and T. F. Williams (Atomic Energy Research Establishment, Harwell, Berks, England). J. Sci. Instr. 33, 64-5(1956) Feb.

By employing a mercury bellows manometer and balancing circuit it has been found possible to measure rapid rates of gas evolution from systems undergoing decomposition under fast electron bombardment from an electrostatic generator. The apparatus is reasonably robust, rapid in response, and gives reproducible results. Much slower rates of gas evolution can also be measured by the same technique. (auth)

6836
A FAST MULTIPLE COINCIDENCE CIRCUIT. B. Collinge, A. W. Merrison, and D. Eccleshall (Univ. of Liverpool, England). J. Sci. Instr. 33, 72-4(1956) Feb.

The multiple coincidence circuit described includes an amplitude discriminator. A trigger circuit generates pulses which are large enough to enable a simple diode coincidence circuit to be used. The resolving time is 20 mμs. The discriminator circuit in each channel will accept two pulses separated by 0.25 μs without loss of sensitivity. The dead time of a single channel, measured using large pulses is less than 0.1 μs. Each channel has been tested at counting rates of 10^5 per s. (auth)

6837
A MAGNETIC DIFFERENTIAL PROBE: ITS EMPLOYMENT FOR THE DETERMINATION OF THE STATIC MEDIAN MAGNETIC SURFACE IN THE GAP OF A SYNCHROTRON. G. Diambrini Palazzi (Istituto Nazionale di Fisica Nucleare, Rome). Nuovo cimento (10) 3, 336-9(1956) Feb. (In English).

A differential magnetic probe, developed for determining the median magnetic surface of the static field in a weak-focusing synchrotron gap, is described. The probe consists of two thin ferromagnetic wires subjected to equal and opposite alternating magnetic fields at 1000 Hz. The method of measurement consists in determining the position of the probe for which the components of the magnetic field along the two wires (parallel to the radius of the synchrotron and lying in a vertical plane) are equal and opposite. The arrangement described gives the localisation of the median magnetic surface within ± 1 mm in static fields between 20 and 500 gauss. The possibility is also mentioned of measuring the field index n by means of this probe with an accuracy of 5% in field not exceeding 500 gauss. Finally the technique used for preparing the ferromagnetic wires is explained in some detail. (auth)

6838
A TWO-DIMENSIONAL SCANNER FOR RADIO-CHROMATOGRAMS. S. Aronoff (Iowa State Coll., Ames). Nucleonics 14, No. 6, 92-4(1956) June.

A relatively simple two-dimensional scanner that prints two dimensional facsimiles of radioactive chromatograms in a fraction of the time required for autoradiography is described. (F.S.)

6839
A DOUBLE AND SLIDING PULSE GENERATOR FOR TESTING ELECTRONIC INSTRUMENTS USED IN NUCLEAR PHYSICS. H. C. Hamers and A. Marseille (Natuurkundig Laboratorium van de Vrije Universiteit, Amsterdam). Physica 22, 563-8(1956) June.

A pulse generator is described which delivers positive or negative single, double, or sliding pulses with a rise time of 0.06 μsec and a decay time of 5 μsec. The length of the flat top is variable from 0.5 μsec up to 7 μsec, the amplitude is accurately measurable and variable from 0.2 mv up to 600 mv. (auth)

Refer also to abstract 7085.

ISOTOPES

6840 AERE-Inf/Bib-98
Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE INDUSTRIAL USES OF ISOTOPES: A SELECTED READING LIST. Mar. 1956. 5p.

6841 ORO-26(Rev.)
REVISED TABLES TO CORRECT FOR PHYSICAL DECAY OF SOME FREQUENTLY USED RADIOISOTOPES. H. D. Bruner, Emory Univ. June 1, 1956. 83p. $0.50(OTS).

The original version of this report was prepared by Oak Ridge Inst. of Nuclear Studies, Inc. under Contract AT-40-1-Gen-133.

Tables are presented which were prepared for the purpose of facilitating correction for the physical decay of some of the more frequently used radioisotopes. The tables are arranged to provide the value of $e^{-\lambda t}$ for the time interval, t, noted in the left margin and fractionally across the top of the table. This value is then used in the expression $N = N_0 \cdot e^{-\lambda t}$ in the usual manner where N is the activity after the time interval, t, and N_0 is the original activity. The values for half life used in computing the tables were supplied by Dr. William H. Sullivan of the Oak Ridge National Laboratory. (auth)

6842
TRITIUM PRODUCTION BY HIGH-ENERGY PROTONS. Lloyd A. Currie and W. F. Libby (Univ. of Chicago) and Richard L. Wolfgang (Brookhaven National Lab., Upton, N. Y.) Phys. Rev. 101, 1557-63(1956) Mar. 1.

The cross sections for T production in various substances by 450-Mev and 2.05-Bev protons have been measured. The N and O cross sections — 25 ± 4 mb and 30 ± 4mb, respectively, at 2.05 Bev — lead to a world-wide average T production rate by cosmic rays of $0.14_{-0.03}^{+0.10}$ T/cm² sec in good agreement with the observed value. The Fe cross section — 53 ± 8 mb at 2.05 Bev — suggests a rate of production of 8.8×10^{-4} T/g sec near the surface of a large meteorite in outer space. For the small Mt. Ayliff Fe meteorite an age of 1.4×10^9 years was calculated from the observed He^3 content. Finally, the results for T production have been compared to those for other light particles. (auth)

6843
CONCERNING THE MASSES OF THE STABLE ZINC ISOTOPES. John T. Kerr, Neil R. Isenor, and Henry E. Duckworth (McMaster Univ., Hamilton, Ont., Canada). Z. Naturforsch. 10a, 840-3(1955) Nov. (In English)

The masses of Zn^{64}, Zn^{66}, Zn^{67}, and Zn^{68} have been studied mass spectroscopically by means of the $O_2^{16}-\frac{1}{2}Zn^{64}$, $\frac{1}{2}Xe^{132}-Zn^{66}$, $\frac{1}{2}Xe^{134}-Zn^{67}$ and $\frac{1}{2}Xe^{136}-Zn^{68}$ doublets. These studies suggest that the currently accepted masses of Zn^{64} and Zn^{66} are too large by ~0.4 mMU. If these revisions are made several existing discrepancies between transmutation and mass data disappear. (auth)

ISOTOPE SEPARATION

6844 KAPL-1272
Knolls Atomic Power Lab., Schenectady, N. Y.
THE ELECTROLYTIC SEPARATION OF HYDROGEN ISOTOPES BY MIGRATION THROUGH A PALLADIUM MEMBRANE. O. N. Salmon. June 25, 1956. 27p. Contract W-31-109-Eng-52. $0.35(OTS).

A process has been demonstrated for the separation of hydrogen isotopes by electrolytic migration through a Pd membrane. The H−D isotope separation factor at room temperature is between 4 and 5. The electrical energy requirement is about ⅓ of that required for separating hydrogen isotopes by electrolysis. The possible use of this process in a simple cascade arrangement is described. (auth)

6845
THE ION SOURCE OF THE AMSTERDAM ISOTOPE SEPARATOR. J. Kistemaker, P. K. Rol, J. Schutten, and C. de Vries. Z. Naturforsch. 10a, 850-6(1955) Nov. (In English)

The following are described in detail: (1) discharge chamber with filament, (2) furnace for the production of the gas (vapor), (3) heated screens and labyrinths, (4) acceleration and lens electrode, (5) power supplies and cooling systems, and (6) arc stabilization. (L.M.T.)

6846
THE ISOTOPIC EFFECT OF PASSAGE OF CURRENT IN MOLTEN POTASSIUM. Arnold Lunden, Carl Reuterswärd, and Alex Lodding. Z. Naturforsch. 10a, 924-6(1955) Dec. (In German)

Direct current of 2900 A/cm density was passed through a 40-cm-long capillary tube with molten K for 14.8 days and K^{41} was formed on the cathode and K^{39} on the anode. The separation factor between the anode and cathode was 1.12, and the mass effect of $U \geq 9 \times 10^{-6}$. (tr-auth)

Refer also to abstract 6864.

MASS SPECTROGRAPHY

6847
FOCUSING PROPERTIES OF A LARGE MASS SPECTROGRAPH NEWLY CONSTRUCTED AT OSAKA UNIVERSITY. Hisashi Matsuda (Osaka Univ., Japan). J. Phys. Soc. Japan 11, 183-91(1956) Mar.

A large double focusing type mass spectrograph was recently constructed at Osaka University in order to increase the accuracy of atomic mass measurement by about one order of magnitude. In this apparatus $\sqrt{2\pi/3}$ cylindrical electric field and $\pi/3$ uniform magnetic field are adopted. The focusing properties of this apparatus are discussed from both theoretical and experimental aspects. The direction and velocity focal planes are calculated, and their deviations due to various conditions such as the change of the position of source, the fringing field effect, the deviation of the geometry, etc. are discussed. These results are compared with the experimental procedure of the focal adjustment. A maximum resolving power of 500,000 was obtained experimentally with present conditions, and the mass dispersion is about 9 cm for 1% mass difference in this case. (auth)

6848
PRELIMINARY REPORT ON A LARGE MASS SPECTROGRAPH NEWLY CONSTRUCTED AT OSAKA UNIVERSITY. K. Ogata and H. Matsuda (Osaka Univ., Japan). Z. Naturforsch. 10a, 843-50(1955) Nov. (In English)

This machine is of the double-focusing type and has a uniform magnetic field of the $\pi/3$ sector type and $\sqrt{2\pi/3}$ cylindrical electric field. The radius of the central ion beam in the magnetic field is 120 cm and that of the electric field 109.3 cm. (L.M.T.)

6849
MASS SPECTROMETER INVESTIGATION OF THE FIELD EMISSION OF POSITIVE IONS. Mark G. Inghram and Robert Gomer (Univ. of Chicago and Argonne National Lab., Lemont, Ill.). Z. Naturforsch. 10a, 863-72(1955) Nov. (In German)

6850
INFLUENCE OF STRAY MAGNETIC FIELDS OF THE QUALITY AND EFFICIENCY OF MASS SPECTROGRAPH AND SPECTROMETER DESIGNS. Richard F. K. Herzog (Air Force Cambridge Research Center, England). Z. Naturforsch. 10a, 887-93(1955) Nov. (In German)

MATHEMATICS

6851 CRT-631
Atomic Energy of Canada Ltd. Chalk River Project, Chalk River, Ont.
TABLE OF COMPLETE ELLIPTIC INTEGRALS. E. A. Taylor and J. M. Kennedy. Feb. 1956. 14p. (AECL-296).

Tables of values to six places for $k^2 = 0(0.001)\ 0.999$ are given from the elliptic integrals K =

$$\int_0^{\frac{\pi}{2}} \frac{d\theta}{\sqrt{1-k^2 \sin^2\theta}} \text{ and } E = \int_0^{\frac{\pi}{2}} \sqrt{1-k^2 \sin^2\theta}\, d\theta.$$ (D.E.B.)

6852 DP-159
Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.
IBM SUB-ROUTINES. II. IRREGULAR BESSEL FUNCTIONS. Julius C. English. May 1956. 24p. Contract AT(07-2)-1. $0.25(OTS).

A sub-routine is given for the IBM 650 to calculate the following functions: ln x, $Y_n(x)$ and $K_n(x)$ for n = 0, 1, 2, and 3. The circular and hyperbolic sines and cosines, and the Bessel functions $J_n(x)$ and $I_n(x)$ for n = 0, 1, 2, and 3 are also available from this routine. (auth)

6853 MURA-NVN-3

Illinois. Univ., Urbana and Midwestern Universities Research Assn., Urbana, Ill.

EXPANSIONS OF THE CHARACTERISTIC EXPONENTS AND THE FLOQUET SOLUTIONS FOR THE LINEAR HOMOGENEOUS SECOND ORDER DIFFERENTIAL EQUATION WITH PERIODIC COEFFICIENTS. Nils Vogt-Nilsen. May 1956. 21p.

Expansions for the characteristic exponents and the Floquet solutions for the linear and homogeneous second order differential equation are derived. The convergence of these series is established. (auth)

6854 NP-6009

Maryland. Univ., College Park.

THE USE OF THE MONTE CARLO METHOD FOR SOLVING BOUNDARY VALUE PROBLEMS INVOLVING THE DIFFERENCE ANALOGUE OF $\partial^2u/\partial x^2 + \partial^2u/\partial y^2 + (K/y)(\partial u/\partial y) = 0$. Interim Technical Report No. 20 [on] FUNDAMENTAL RESEARCH IN APPLIED MATHEMATICS (thesis). Louis W. Ehrlich. June 1956. 52p. Project 5B99-01-004. Contract DA-36-034-ORD-1486.

The "Monte Carlo" method was applied to solving difference equation analogues of some elliptic partial differential equations with given boundary values and to compare the results with those of various iterative schemes used to solve the difference equations. The method was coded for the Ordvac. The "Monte Carlo" method was found to be not as satisfactory as the iterative methods for the difference equations used here. (F.S.)

6855 WAPD-LSR(P)-30

Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.

PROBLEM 54-THE CUTHILL CODE. R. S. Varga. June 1955. Changed from OFFICIAL USE ONLY May 28, 1956. 20p. (Includes Addendum I by R. S. Varga. Aug. 1955. and Addendum II by Joyce Pickard. Oct. 1955). Contract AT-11-1-GEN-14. $3.30(ph OTS); $2.40(mf OTS).

The mathematical analysis of the Cuthill Code for solving two-or three-group two-dimensional reactor simulator problems is given. (F.S.)

6856

ON A REGULAR CAUCHY PROBLEM FOR THE EULER-POISSON-DARBOUX EQUATION. E. T. Copson (Univ. of St. Andrews). Proc. Roy. Soc. (London) A235, 560-72(1956) June 12.

A new method is given for solving the wave equation in space of any odd number of dimensions without making use of any device for evaluating divergent integrals. This gives the clue to a simple method of solving the regular Cauchy problem for the so-called Euler-Poisson-Darboux equation in space of any odd number of dimensions, a problem which has previously only been solved by a very difficult extension of Marcel Riesz's method. (auth)

MEASURING INSTRUMENTS AND TECHNIQUES

6857 AD-50451

Bausch and Lomb Optical Co., Rochester, N. Y.

RADIOPHOTOLUMINESCENT GLASS PRODUCTION TECHNIQUES. Final Development Report. N. J. Kreidl. [1954]. 46p. Contract NObsr-57010.

Techniques and equipment were developed for producing radiophotoluminescent glass at the rate of 5000 pieces of specified dimensions per day. This glass serves as the sensitive element in a radiation detector and must be capable of indicating an accumulative dosage of x and γ radiation over the 0 to 600 r range. (C.H.)

6858 AMRL-237

Army Medical Research Lab., Fort Knox, Ky.

A METHOD FOR RAPID DETERMINATION OF RADIOCARBON IN ANIMAL TISSUES. Eli M. Pearce, Frank DeVenuto, Walter M. Fitch, Hilliard E. Firschein, and Ulrich F. Westphal. Mar. 1, 1956. 18p. Project No. 6-64-12-028.

A simple technique was developed for solid counting of radiocarbon samples prepared from animal tissues containing cortisol-4-C^{14}. The dry tissues were dissolved in hot formamide, plated on Al planchets and dried. The self-absorption of these preparations was found to be linearly proportional to the sample thickness. Use of lens paper improved the consistency of the counts. The procedure is considered applicable to the estimation of radioactivity in nonvolatile compounds. (auth)

6859 LA-1990

Los Alamos Scientific Lab., N. Mex.

SENSITIVITY OF A COMPTON DETECTOR. Robert M. Kloepper and Victor A. Madsen. Sept. 1955. 25p. Contract W-7405-eng-36. $0.25(OTS).

An insensitive gamma-ray detector utilizing the Compton process is described. The sensitivity of this type detector was investigated theoretically and experimentally. It would find application in very high gamma-ray fluxes. (F.S.)

6860 NML-5115-B-19.15(Pt.4)

Naval Material Lab., Brooklyn.

RESEARCH ON PULSES FROM GEIGER-MUELLER TUBES OPERATED FROM A HIGH VOLTAGE SUPPLY WITH RIPPLE. Final Report. W. G. Egan. Sept. 27, 1954. 28p. (AD-48701).

An investigation was conducted on pulses obtained from G-M tubes operated from a HV supply with 3 types of ripple (60-c sinusoidal and narrow and wide rectangular pulses). Three types of G-M tube were investigated: 5979/BS-1, 5980/BS-2, and GL-15. Results indicate that the shape of the G-M pulse is affected by the type and amplitude of the ripple. In general, more spurious peaks follow the pulse with increased amplitude. These effects make the plateau trace, which is obtained, (as well as the operation in radiac sets) a function of the ripple conditions imposed by the associated circuitry. If accurate values of starting voltage and relative plateau slope are to be obtained, it is necessary to use a power supply with negligible ripple. Ripple voltage in radiac survey sets can be minimized by the use of a voltage regulator such as a BS-101 tube. (ASTIA abst.).

6861 NP-5900

National Radiac, Inc., Newark, N. J.

DEVELOPMENT OF THE RADIACMETER IM-86()/PD. Final Report. Julius Gluck, I. Schulz, David Spielberg, and J. L. Zar. Dec. 31, 1955. 42p. DA Project No. 3-12-80-031; SC Project No. 06-213A. Contract DA-36-039-SC-42597.

The Radiacmeter IM-86()/PD is a γ-ray sensitive ratemeter covering the ranges 0 to 50 mr/hr to 0 to 500 r/hr in five linear decade ranges. It utilizes a scintillation crystal whose light output, proportional to the radiation field, is measured by a photoelectric cell and electrometer amplifier. Power for the circuit is obtained from dry cell batteries. The indicator is a sensitive microammeter of new design, calibrated to read directly in mr/hr. This instrument avoids the use of a photomultiplier tube and its attendant high voltage power supply. The development of three experimental models of this instrument is described. (C.H.)

6862 SCEL-M-1715

Evans Signal Lab., Belmar, N. J.

A RADIATION-SENSITIVE ALKALI-BARIUM GLASS FOR POSSIBLE USE AS A DOSIMETER. Carol J. Koerbel. Aug. 15, 1955. 60p. Project Nos.: Signal Corps 196A, Da 3-99-04-061.

An alkali–barium glass (Pittsburgh Plate Glass Co., No. 182) was evaluated for use as a possible visual radiation dosimeter. The sensitivity of the glass, and the effects of light, time, and temperature were investigated. Data are presented graphically and the sensitivity is compared to a sample of No. 250 glass. Advantages and disadvantages of the glass as a radiation dosimeter are summarized and points for further study and improvement are suggested. (C.H.)

6863

SIMPLIFIED METHOD FOR CONSTRUCTION OF EMULSION CALIBRATION CURVES. G. V. Wheeler (Phillips Petroleum Co., Idaho Falls, Idaho). Appl. Spectroscopy 10, No. 1, 11(1956) Feb.

This method for the construction of emulsion calibration curves utilizes a specially prepared graph paper whose coordinates are labeled in terms of percent transmission but are proportional to values of the corresponding Seidel functions. Data for the preliminary curve are plotted directly on this paper and are then transferred to Seidel-logarithmic graph paper. (B.J.H.)

6864

DIRECT-COUPLED AMPLIFIER AND RADIOMETER FOR A SINGLE-BEAM MASS SPECTROMETER. Carl Reutersward. Arkiv Fysik 10, No. 6, 501-24(1956).

Design considerations and details of construction are given for an amplifier intended for precision measurements on isotopes of low abundance by rapid scanning of the mass spectrum. For continuous accurate determination of isotope ratio, the single-beam mass spectrometer is converted to a two-isotope ratio meter by combining an automatic switching device with a null method of comparing voltages. (auth)

6865

ABSOLUTE STANDARDIZATION OF FERROUS SULFATE DOSIMETRY. SOFT X RAYS OF 10 AND 8 KEV. M. Cottin and M. Lefort. J. chim. phys. 53, 267-73(1956) Mar. (In French).

A determination was made of the oxidation yield of ferrous sulfate by soft x rays (8 and 10 kev). The calibration was made with a Rogozinski-type chamber. The determinations were in agreement with those obtained from Co γ rays and tritium β rays. They show specifically that the oxidation yield of ferrous sulfate decreases when the mean linear ionization density increases. (tr-auth)

6866

A HIGH PRESSURE CLOUD CHAMBER FOR COSMIC RAY OBSERVATION. Saburo Miyake (Osaka City Univ., Japan). J. Phys. Soc. Japan 11, 195-201(1956) Mar.

A high pressure cloud chamber (50 cm in diam., 20 cm deep and used at 150 atm.) was built in the summer of 1952. The cloud chamber can be operated automatically by counter control with a recycling time of about 20 minutes. It was filled with 5.6 kg of nitrogen or 8 kg of argon gas in its illuminated space of about 30 liters, and it became much easier to observe some cosmic ray phenomena, especially those events occurring in the gas nuclei, in comparison with observations using the smaller type chamber (25 cm in diam., 7 cm deep and used at 100 atm.) which has been used previously. (auth)

6867

COUNTING OF CARBON-14 IN THE SOLID STATE. A. K. Das Gupta and C. K. N. Nair (National Chemical Lab. of India, Poona). J. Sci. Ind. Research (India) 15B, 1-3(1956) Jan.

A radiometric procedure for the determination of C^{14} in labeled compounds by precipitating, collecting, and counting $BaCO_3$ samples is outlined. The method gave reliable and reproducible results in routine determinations. (C.W.H.)

6868

A SCINTILLATION COUNTER FOR THE ASSAY OF RADIOACTIVE GASES. D. R. Stranks (Univ. of Leeds, England). J. Sci. Instr. 33, 1-4(1956) Jan.

A glass chamber, with a plastic scintillator serving as one wall, may be used to assay gaseous samples of weak β-emitting nuclides (notably C^{14}). The specific activities of duplicate samples can be reproduced to ±0.5%. Since the observed counting rate of an active gas sample is independent of gross impurities and the chemical form of the nuclide, sample preparation is simpler and faster than for other gas-counting methods. The scintillation counter assembly can be readily adapted to the assay of both liquid and solid samples; the method described for liquid assays has certain advantages over existing methods. (auth)

6869

A CALORIMETER FOR MEASURING ENERGY ABSORPTION FROM PILE RADIATION. A. R. Anderson and R. J. Waite (Atomic Energy Research Establishment, Harwell, Berks, England). J. Sci. Instr. 33, 46-51(1956) Feb.

An adiabatic calorimeter has been designed for the measurement of energy absorption from pile radiation. Some of the unusual problems encountered in this type of calorimetry are discussed. The preliminary work leading to a suitable design of calorimeter is summarized, and full descriptions of the instrument and measurement techniques are given. Electrical calibrations of three samples with widely different thermal conductivities have demonstrated the satisfactory behaviour of the calorimeter over a wide range of power inputs. The results of some measurements in the Harwell pile BEPO are briefly discussed. (auth)

6870

A SIMPLE AIR LOCK FOR IONIZATION GAUGES. C. Barrow (Univ. of Birmingham, England). J. Sci. Instr. 33, 83(1956) Feb.

6871

A PORTABLE $\beta-\gamma$ RADIATION MONITOR. B. W. Emmerson and S. P. Newbery (Royal Cancer Hospital, London). J. Sci. Instr. 33, 83-4(1956) Feb.

Descriptions and circuit diagrams are given for a lightweight portable $\beta-\gamma$ radiation monitor. A halogen-quenched Geiger–Mueller tube is used as the detector, and a 15 mg glass end window allows response to both β and γ radiation. (B.J.H.)

6872

THE GAS-MULTIPLIER: A NEW TYPE OF ELECTRON MULTIPLIER. C. H. Vincent (Univ. of Edinburgh). Nature 177, 391-2(1956) Feb. 25.

6873

A SIMPLE WIDE-RANGE GAMMA DOSE-RATE METER. K. E. G. Perry and C. C. H. Washtell (Atomic Energy Research Establishment, Harwell, Berks, England). Nuclear Power 1, 17-19 & 28(1956) May.

This dose-rate meter, which covers in a single range 10 mr/hr to 10,000 r/hr has been designed for Health Physics purposes. The circuit employs an electrometer pentode as the logarithmic element in a d-c amplifier to measure the current in an ionization chamber, the meter presentation being on a logarithmic scale. (auth)

6874

AN ALPHA SCINTILLATION COUNTER FOR SOLID SAMPLES. John F. Frazer (Massachusetts Inst. of Tech., Cambridge). Nucleonics 14, No. 6, 88(1956) June.

An alpha scintillation counter for measuring solid samples is described. It provides a phosphor screen with a thickness of about 10 mg/cm^2 covering an area of 15.9 cm^2. (F.S.)

6875

GLASS SLIDES HELP MAP GAMMA FIELDS. R. G. Bauman (B. F. Goodrich Research Center, Breckville, Ohio). Nucleonics 14, No. 6, 90-1(1967) June.

Standard glass microscope slides may be used effectively in mapping high-level gamma flux distribution if its optical density is measured within 10 hrs of its removal from the field. (F.S.)

6876

PHOTOGRAPHIC METHODS IN γ-RAY SCINTILLATION SPECTROSCOPY. B. Chinaglia and F. Demichelis (Istituto di Fisica Sperimentale del Politecnico, Torino). Nuovo cimento (10) 3, 51-8(1956) Jan. (In English)

Experimental research on the different possibilities to get efficient photographic methods of γ spectroscopy through scintillation crystals is discussed. The spectrum is always strongly disturbed by the Compton distribution, and the possibilities to reduce it by a fitted geometry of the crystals and an anticoincidence device, or by using a proper sized crystal, are discussed. In any case, the resolving power is rather poor owing to the fluctuations in every stage of the process from the γ ray to the recorded pulse. Strong improvements have been reached by a number of laboratories in the photomultipliers as well as, in the crystals and in their mounting. This is proved comparing, recent spectrograms with those which it was possible to obtain several years ago. (auth)

6877

SPURIOUS SCATTERING IN NUCLEAR EMULSIONS. E. Lohrmann and M. Teucher (Physikalisches Institut der Universität, Bern Switzerland). Nuovo cimento (10) 3, 59-65 (1956) Jan. (In English)

In full agreement with the results of Biswas, Peters and Rama, further evidence is presented on a new form of noise in scattering measurements in nuclear emulsions, which is supposed to be produced by small dislocations in the emulsion and appears to be found in every kind of emulsion. As its mean sagitta increases about proportional to the cell length, it can be mistaken for true Coulomb scattering and affects scattering measurements at $p\beta > 2$ Bev/c very seriously. As a possible consequence, the mean energy leading to a given multiplicity of shower particles seems to have been greatly underestimated. The effect could give a bias towards low mass values at mass determinations of particles of high energies by the scattering-ionization method. The ratio of third to second differences was found to be 1.45 ± 0.034, also not far from the value 1.30 given for Coulomb scattering. (auth)

6878

MINIMUM NOISE PRE-AMPLIFIER FOR FAST IONIZATION CHAMBERS. C. Cottini, E. Gatti, G. Giannelli, and G. Rozzi (Laboratori CISE, Milan). Nuovo cimento (10) 3, 473-83 (1956) Feb. (In English).

A fast, low-noise, pulse amplifier is described, which has an input stage consisting of a cascade of two triode-connected E83F tubes. Its rms noise voltage is equivalent to a pulse of 280 electronic charges injected on an input capacity of 21 $\mu\mu$F, the frequency response of the amplifier being defined by two RC circuits both having a time constant of 1.5μs. For a capacity of 34 $\mu\mu$F and a frequency response given by time constants of 3μs, the rms noise is equivalent to a pulse of 380 electronic charges. (auth)

6879

REMARKS ON THE OPERATION OF THE DIFFUSION CLOUD CHAMBER. II. P. E. Argan and A. Gigli (Istituto di Fisica dell'Universita, Genova) and N. D'Angelo (Istituto Superiore di Sanita, Rome). Nuovo cimento (10) 3, 1337-59 (1956) June.

6880

LIGHT PULSES EXCITED BY α PARTICLES IN ARGON. A GASEOUS SCINTILLATION DETECTOR. M. Forte (Laboratori CISE, Milan). Nuovo cimento (10) 3, 1443-55 (1956) June.

The light pulses produced by the passage of individual α-particles through gases have been detected and analyzed by means of a suitable experimental technique. The time shape of pulses obtained with argon of various purities was studied with respect to the mechanism of photon production, and the possibilities of the particle detectors based on the gas scintillation were investigated. A scintillation chamber filled with argon was found to be suitable for the spectral analysis of α-particles, yielding a 13% resolution at ~5 Mev, for instance. The resolving time of this instrument is a very short one. (auth)

6881

BUBBLE COUNTING FOR THE DETERMINATION OF THE VELOCITIES OF CHARGED PARTICLES IN BUBBLE CHAMBERS. Donald A. Glaser (Univ. of Michigan, Ann Arbor) and David C. Rahm (Brookhaven National Lab., Upton, N. Y.) and Cyril Dodd (Univ. Coll., London). Phys. Rev. 102, 1653-8(1956) June 15.

The density of bubbles along tracks in a liquid propane bubble chamber has been measured as a function of particle velocity for positive pions and protons with velocities $\beta = \nu/c > 0.4$. For temperatures from 55 to 59.5°C the bubble density, b, is described by $b = (A/\beta^2) + B(T)$, where A = 9.2 ± 0.2 bubbles/cm and B is a function of temperature only. Velocities can be determined by bubble counting, using fast comparison tracks of known velocity, with a final average error in velocity of 5% for proton tracks 10 cm long. Accurate temperature control is not required to obtain this accuracy by using this method. (auth)

6882

A NEW SENSITIVE CHEMICAL ACTINOMETER. II. POTASSIUM FERRIOXALATE AS A STANDARD CHEMICAL ACTINOMETER. C. G. Hatchard and C. A. Parker (Admiralty Materials Lab., Dorset, England). Proc. Roy. Soc. (London) A235, 518-36(1956) June 12.

Earlier experiments with potassium ferrioxalate were extended and a detailed study was made of the photolysis of the acidified solutions previously recommended for chemical actinometry. Accurate values of quantum efficiency have been determined at twelve wavelengths between 254 and 578 mμ, and the effects of temperature, light intensity and photolyte composition have been investigated. At some wavelengths independent values of quantum efficiency have been obtained by comparison with uranyl oxalate and by direct comparison with a calibrated thermopile. The results indicate that potassium ferrioxalate provides a very valuable new chemical actinometer, and its use is recommended in place of uranyl oxalate for many purposes. Full working details for the use of the actinometer are provided. (auth)

6883

APPLICATIONS OF THE MAYNEORD CONTOUR PROJECTOR TO VARIOUS DOSAGE PROBLEMS IN RADIOTHERAPY. Victoria Castro, Charles Soifer, and Edith H. Quimby (Columbia Univ. Coll. of Physicians and Surgeons, New York). Radiology 66, 362-73(1956) Mar.

Applications of the Mayneord contour projector to problems of three-dimensional radiation dosage are described. (C.H.)

6884

EXPERIMENTS IN THE PHOTOGRAPHIC MONITORING OF STRAY X-RAYS. PART I. GENERAL CONSIDERATIONS. THE CHOICE OF FILM-CALIBRATING RADIATIONS IN

ROENTGEN THERAPY AT 220 KVP AND 1,000 KVP. R. B. Wilsey, D. H. Strangways, and G. M. Corney. (Eastman Kodak Co., Rochester, N. Y.). Radiology 66, 408-17 (1956) Mar.

The technic of the photographic measurement of radiation quantity and quality is discussed in relation to film monitoring and to experiments described in this paper. With therapeutic x ray installations at 200 to 250 kv, completely enclosed in a protective barrier, either the heavily filtered primary radiation or the γ rays of radium are satisfactory choices for exposing the calibrating films. If the situation is such that the stray radiation to be measured is predominantly scattered radiation from the patient, the normally filtered primary x ray beam is the best choice for film calibration. With 1,000-kv x rays, the primary radiation, either filtered or unfiltered, or the γ rays of radium may be used for exposing the calibration films. If the arrangement is such that scatter from the patient may reach neighboring personnel, some overvaluation of this scatter may occur. (auth)

6885

EXPERIMENTS IN THE PHOTOGRAPHIC MONITORING OF STRAY X-RAYS. PART II. THE CHARACTERISTICS OF THE STRAY RADIATIONS, AND THE CHOICE OF FILM-CALIBRATING RADIATIONS IN DIAGNOSTIC RADIOLOGY. R. B. Wilsey, H. R. Splettstosser, and D. H. Strangways (Eastman Kodak Co., Rochester, N. Y.). Radiology 66, 418-28(1956) Mar.

Filtration tests of the radiation scattered from an oval-shaped water phantom, exposed at 70 kvp, showed that the lateral scatter and the backward scatter differed little in quality from the primary radiation, while the forward scatter was somewhat harder than the primary x rays. Films calibrated by the primary radiation were found to evaluate satisfactorily the radiation scattered in all three directions, at voltages of 70 kvp, 100 kvp, and 125 kvp. Diaphragming the primary x rays, as in fluoroscopy, restricted the beam to thicker portions of the phantom and hardened the radiation scattered in both the forward and lateral directions. All these radiations, however, were satisfactorily evaluated by films calibrated by the primary radiation, with exposures at both 80 kvp and 100 kvp. It is concluded, therefore, that all the scattered radiation occurring in x ray diagnostic procedures is adequately evaluated by films calibrated by the primary radiation. Under most practical conditions, the intensity of the direct stray radiation is small compared to that of the scattered radiation and can be ignored in choosing the calibrating radiation, but if the primary x ray beam is sufficiently diaphragmed at voltages above 80 kvp, the intensity of the scattered radiation may not greatly exceed that of the direct stray radiation. Under these circumstances, the monitoring films should be calibrated by the heavily filtered primary radiation. Normally, for a 100-kvp generator, the best choice of voltage for film calibration would be that most commonly used in the x ray examinations. With the 125-kvp generator, film calibration at 125 kvp would give the highest evaluation of the stray radiation and is to be preferred. The walls of the x ray room contribute an appreciable portion of the stray radiation. Plaster or masonry walls scatter less than half as much as wood or other light material. In terms of ionization measurement, iron or steel covered with 0.25 mm of Al emits the least intensity of secondary radiation. (auth)

6886

RADIATION DOSE DISTRIBUTION IN WATER FOR 22.5-MEV-PEAK ROENTGEN RAYS. G. Shapiro, W. S. Ernst, and J. Ovadia (Sloan-Kettering Inst., New York). Radiology 66, 429-37(1956) Mar.

An automatic isodose recorder was used for the determination of isodose contours produced by a radiation beam in water. The design of a collimator and of a compensating filter for 22.5-Mev-peak x rays from the betatron is described. Depth dose measurements in water at target surface distances of 80 cm, 100 cm, and 120 cm for fields ranging in area from 7 to 225 sq cm are presented. It was found that the absorption coefficient for 22.5-Mev x rays in water varies linearly with the square root of the field size. A formula for determining the central-axis depth dose for the field sizes and target distances investigated is given. Representative isodose curves for a number of fields at normal and oblique incidence are reproduced. (auth)

6887

INVESTIGATION OF THE GAMMA RADIATION FROM THE HUMAN BODY. Rolf M. Sievert. Strahlentherapie 99, 185-95(1956) Feb. (In German).

Investigations of the γ radiation from human beings are reported. Two pressure ionization chamber apparatures in a low background laboratory, situated in a rock near Stockholm, have been used for testing more than 500 persons. The variations in the normal γ-radiation with age, sex and body weight are described. Some viewpoints are given concerning the usefulness of continuously working simple instruments for extensive γ-radiation measurements on living subjects. (auth)

6888

REALIZATION OF HOMOGENOUS DOSE DISTRIBUTION BY RADIATION ROTATION. Olov Dahl, Robert Thoraeus, and Karl Johan Vikterlöf. Strahlentherapie 99, 196-202(1956) Feb. (In German).

Problems connected with the adjustment of the position and size of the axis field in rotation therapy have been investigated. For practical purposes a tumor volume may be considered homogeneously irradiated, even if smaller differences exist between the dose values at various points. The correlation between the axis field used and the dimensions of the corresponding homogeneously irradiated volume has been investigated by measurements of the does distribution in phantoms and patients. The value of using compensating filters has been verified, and that of making dose measurements in both anatomical phantoms and patients is stressed. (auth)

6889

PLEXIGLAS AS PHANTOM MATERIAL FOR MEASURING THE DOSE DISTRIBUTION OF FAST ELECTRONS. Claus-Benedict v. d. Decken. Strahlentherapie 99, 227-9(1956) Feb. (In German).

By means of comparison measurements of the depth dose curve the report shows that for the measurement of the dose distribution in case of irradiation of quick electrons plexiglass is approximately equivalent to water. (auth)

6890

THE ELECTROMETRIC PHOTOCELL COMPENSATOR; A NEW INSTRUMENT FOR MEASUREMENT OF DOSES AND DOSE RATE OF IONIZING RADIATIONS. Walter Hübner. Strahlentherapie 96, 461-8(1955) Mar. (In German)

The author developed an electrometric photocell compensator with adaptable measuring ranges, to be used for the purpose of automatically compensating electrostatic charges and voltages in connection with measurements of the dose and the dose rate of ionizing radiations. He indicates the mode of action, circuit designs, sensitiveness, and inexactitudes of measurement of this new device. (auth)

6891

THE DOSE RATE FROM THREE-DIMENSIONAL GAMMA EMITTERS DETERMINED WITH CdS CRYSTAL AS WELL AS MATHEMATICAL DIAGRAM. W. Gahlen. Strahlentherapie 96, 474-7(1955) Mar. (In German)

The dose rate of three-dimensional emitters such as Co^{60}

in the form of Plastobalt, can be mathematically calculated, photographically determined, and directly measured by means of the gammameter containing a cadmium sulfide crystal. The same values are obtained with the three methods. (auth)

Refer also to abstracts 6507, 6509, 6549, and 6914.

MESONS

6892

NUCLEAR INTERACTIONS OF HIGH ENERGY PROTONS IN COPPER. N. M. Kocharyan, G. S. Saakyan, M. T. Aĭvazyan, Z. A. Kirakosyan, and A. S. Aleksanyan (Armenian Inst. of Physics). Doklady Akad. Nauk S.S.S.R. 107, 668-70(1956) Apr. 11. (In Russian)

A magnetic spectroscope was used for measuring the total cross section for inelastic interactions of up to 12-Bev protons with copper nuclei. In a graphite absorber of 40 g/cm^2 thickness, located over the magnet, protons and π mesons were generated by cosmic neutrons. Investigations were made of interactions of these particles in a copper absorber, located under the magnetic aperture. Data are given for determining the cross section for interactions of negative π mesons. For inelastic interactions of protons with copper in the energy range of $1 \lesssim E \lesssim 5$ Bev, the total cross section changes slowly and is equal to $\sim 0.75\ \sigma_0$ ($\sigma_0 = 0.98 \times 10^{-24}$cm^2 to geometric cross section); in $E \gtrsim 5$ Bev, it is equal to the geometric cross section, and for the inelastic interactions of π mesons with copper nuclei, the cross section is larger than the cross section for protons. For the $E \gtrsim 1$ Bev, it is equal to σ_0. (R.V.J.)

6893

SPIN AND PARITY ANALYSIS OF BEVATRON τ MESONS. J. Orear, G. Harris, and S. Taylor (Columbia Univ., New York). Phys. Rev. 102, 1676-84(1956) June 15.

The data of 71 τ^+ decays found in emulsions exposed at the Bevatron are presented and analyzed. These data are free from selection bias favoring short-ranged pions. Of these 71 events, 13 have negative pions under 10 Mev and one event has a π^+ of (0.38 ± 0.03) Mev. Assuming the distribution functions proposed by Dalitz, the relative probabilities that the 71 events turn out the way they did are 1, $10^{-7.9}$, $10^{-33.5}$, $10^{-6.8}$, $10^{-10.5}$, and $< 10^{-2}$ for the respective (0−), (1+), (1−), (2+), (3−), and (3+) spin and parity configurations. The (0−) distribution function of Dalitz is statistically a good fit to the data. In addition, 55 MIT and 100 Berkeley τ decays are shown to behave essentially the same way. No indication of polarization of the Bevatron τ beam was found. Conclusions are drawn from the data that the τ and θ mesons have different spin-parity configurations and that the only reasonable possibilities for the τ are (0−) and (2−). The data are also used to give an upper limit for the s-wave pion-pion interaction. (auth)

6894

THE ENERGY SPECTRUM OF THE ELECTRONS FROM μ MESON DECAY IN NUCLEAR EMULSIONS. A. Bonetti, R. Levi Setti, M. Panetti, and G. Rossi (Istituto di Scienze Fisiche dell'Università, Milan) and G. Tomasini (Istituto di Fisica dell'Università, Genova). Nuovo cimento (10) 3, 33-50(1956) Jan. (In Italian)

An energy spectrum of the decay electrons of μ mesons has been obtained by scattering measurements on 506 tracks. The measurements were made by the coordinate and the angular method; the energies were calculated with the scattering constant of Goldschmidt-Clermont, allowing for variation with velocity and cell-size. The variances on the individual mean angles of scattering were deduced from the Molière-d'Espagnat theory. The experimental spectrum, blurred due to the straggling introduced by bremsstrahlung and the dispersion of the scattering measurements, is compared with the theoretical spectra (deduced from the theories of Michel and of Porter and Primakoff) modified to take into account these two effects. The statistical method of "maximum likelyhood" has been applied to the estimation of the shape parameter ρ introduced by Michel, referring in the present experiment to a mixture of positive and negative particles ($\rho\pm$). The result is $\rho \pm \approx 0.57 \pm 0.14$, in which the error depends mainly on the uncertainty in the scattering constant and on the fluctuations of frequency of the experimental spectrum. The present value of $\rho\pm$ is close to those obtained by experimenters making use of other techniques. (auth)

6895

NUCLEAR INTERACTIONS OF NEGATIVE K-MESONS IN NUCLEAR-RESEARCH EMULSION. E. P. George, A. J. Herz, J. H. Noon, and N. Solntseff (Univ. of Sydney, Australia). Nuovo cimento (10) 3, 94-117(1956) Jan. (In English)

A large emulsion stack was exposed at the Bevatron to K^- mesons of life time of the order of 10^{-8} s. Fifty-two K^- particles were observed, among which 12 stopped with no visible decay or interaction, 28 ended in an evaporation star, 9 gave a fast π meson as well as an evaporation star, 1 ejected a hyperon and a π^- meson, 1 produced the emission of what may be either a hyperdeuteron coming to rest or a Σ^+ decaying into a proton in flight, and there is 1 case of an evaporation star closely associated with a possible Λ^0 decay. Particular importance is attached to the possible hyperdeuteron as the existence of such a particle would be in contradiction to the theory of Gell-Mann as well as allowing one to estimate the strength of the nuclear interaction of the hyperon involved. The main features of the nuclear events are (i) the overall average excitation energy of the evaporation stars is about 150 Mev, (ii) π mesons are emitted from about 17% of the events and most of these, if not all, are negatively charged, (iii) charged hyperons are emitted from a small fraction of the events (one in this case, accompanied by a π meson), (iv) the mean kinetic energy of the emitted π mesons is 40 Mev, and (v) the mean prong number of the evaporation stars associated with π meson emission is significantly greater than the overall average. All these features can be explained qualitatively by one mechanism: the K^--particle enters into the nucleus then interacts with one nucleon in the presence of other nucleons which take up part of the available energy according to the reaction $K^- + N + \text{nucleons} \rightarrow Y + \pi + \text{nucleons} + Q$. As the primary absorption process occurs fairly near to the nuclear surface, the secondaries from this reaction each have a probability of about 50% of escaping without contributing to the nuclear excitation. The hyperons involved appear to be the Λ^0 and the isotopic-spin triplet Σ^+, Σ^0, Σ^-; and the observations require that the production of Λ^0's is of the order of ten times more frequent than that of any particle of the Σ group. (auth)

6896

HEAVY UNSTABLE PARTICLES PRODUCED IN THE HIGH ENERGY PION BEAM OF THE BERKELEY BEVATRON. M. Schein, D. M. Haskin, and R. G. Glasser (Univ. of Chicago). Nuovo cimento (10) 3, 131-40(1956) Jan. (In English)

Stacks of 600 μm pellicles were exposed to the 4.6 and 3.0 Bev pion beam of the Berkeley Bevatron. A number of heavy unstable particles and hyperfragments were obtained. The ratio of the frequency of occurrence of K^+ and K^- mesons has been found to be approximately unity in contrast to the large positive excess in the proton beam. As a possible explanation, it is suggested that the K^- meson is produced in conjunction with a K^+ meson according to the fol-

lowing reaction: $\pi^- + p \rightarrow K^+ + K^- + N$. Two hyperfragment decays of hydrogen have been found in which the π^- meson stops. One of the hyperfragments was identified as a H^4 produced by a Σ^- hyperon; the other one is a H^3 produced directly by the high energy pion. The range of all the charged particles was accurately determined which yielded a reliable value of the binding energy. The value of the binding energy (B.E.) for H^3 was found to be 1.2 ± 0.6 and for H^4 B.E.$(\Lambda^0) = 3.3 \pm 1$. The mean free path for nuclear collisions was determined for 5.7 Bev protons and 3 Bev π^- mesons. The results yielded for protons 37.6 ± 5.3 cm and for π^- mesons 35.5 ± 5.0 cm. Both mean free paths are longer than the geometrical mean free path for nuclear collisions in the emulsion, which is 25 cm. (auth)

6897

EXCITATION OF NUCLEI BY ABSORPTION OF π^--MESONS. III. A. Tomasini (Istituto di Fisica dell'Università, Bologna). Nuovo cimento (10) 3, 160-8(1956) Jan. (In English)

The results of two previous papers by Puppi et al. are revised here. The problem of the excitation of a medium heavy nucleus by a bound π^- meson was examined assuming that the pion is absorbed by a nucleon pair; the subsequent disintegration being described as a two step process: a direct emission followed from an evaporation. This evaporation process is revised, using a more refined formula. Level densities obtained from disintegration experiments are used; it is shown that the recoil of the nucleus is not negligible in the emission of α particles; values of level densities differentiated for α particles and nucleons are used. The results obtained in the case of absorption by a neutron-proton pair are in good agreement with experimental data. It is concluded that the bound π^- mesons are absorbed by neutron-proton pairs; other modes of absorption (by proton-proton pairs or by other nucleon groupings) seem to be quite improbable. (auth)

6898

ON THE SPIN AND PARITY OF THE τ-MESON. G. Costa and L. Taffara (Istituto di Fisica dell'Università, Padova). Nuovo cimento (10) 3, 169-79(1956) Jan. (In English)

The angular distributions of the secondaries of the τ meson have been calculated for eight combinations of spin and parity, using the hypothesis accepted until now about the type of interaction. Comparing these distributions with the experimental data, one finds a satisfactory agreement for the cases of even spin and odd parity, especially for the $[0,-]$ case. (auth)

6899

AN ANOMALOUS V^0 EVENT. M. Deutschmann (Max-Planck-Institut für Physik, Gottingen) and M. Cresti, W. D. B. Greening, L. Guerriero, A. Loria, and G. Zago (Istituto di Fisica dell'Università, Padova). Nuovo cimento (10) 3, 180-3(1956) Jan. (In English)

An event has been observed in a multiplate cloud chamber which has the typical aspect of an anomalous V^0 decay: it is compatible with the decay scheme $\tau^0 \rightarrow \pi^+ + \pi^- + \pi^0 + 80$ Mev. (auth)

6900

THREE EXAMPLES OF COMPLETE τ-DECAY. M. Scharff (Univ. of Copenhagen, Denmark) and, G. Gjeldaker and S. O. Sørensen (Univ. of Oslo, Norway). Nuovo cimento (10) 3, 216-18(1956) Jan. (In English)

6901

CHARGE PROPERTIES OF THE WEAK DECAY INTERACTIONS OF THE NEW PARTICLES. R. Gatto (Istituto di Fisica dell'Università, Rome). Nuovo cimento (10) 3, 318-35(1956) Feb. (In English).

Relations and inequalities are given—which can be verified by experiment—between the transition probabilities of different decay modes of new particles and light hyperfragments. In particular, restrictions are found for the relative probabilities of the different decay modes of charged Σ particles, for the relative probability of the τ and of the τ' decays, and for the different mesonic decay modes of the lightest Λ° nuclei. These restrictions follow from the hypothesis that the weak decay interactions transform in charge space as the component, which satisfies charge conservation, of a spherical tensor of rank $\frac{1}{2}$. (auth)

6902

SOME COMMENTS ON K^- INTERACTIONS AT REST. J. M. Blatt and S. T. Butler (Univ. of Sydney, Australia). Nuovo cimento (10) 3, 409-23(1956) Feb. (In English).

It was concluded that: (1) The energy spectrum of the charged π mesons emerging from K^- captures at rest indicates, together with other evidence, that K^- capture occurs only well within nuclear matter, not at the nuclear surface. A very tentative hypothesis is suggested as an explanation, which can be tested by studying interactions in flight of K^- measons passing through hydrogen. (2) A low energy ($\simeq 20$ Mev) Λ^0 has a long mean free path in nuclear matter, at least of the order of the radius of one of the heavy nuclei in nuclear emulsions. This excludes strong Λ^0-nucleon forces of any kind, be they attractive or repulsive. (3) If a hyper-deuteron exists, it cannot be interpreted as a compound of a Λ^0 and a proton; if it emerges from a K^- capture at rest, it can also not be a compound of a K particle and a nucleon. The only remaining reasonable interpretation, a compound of a Σ and a nucleon, violates conservation of strangeness. It is urged that experimentalists measure carefully any event suspected to be of this type. (4) Measurement of the K^+/K^- ratio in neutron bombarment of nuclei would provide a direct test of the strangeness selection rule, as distinguished from the less specific « law of associated production ». (auth)

6903

ON GENERALISED DISPERSION RELATIONS. A. Salam (St. John's Coll., Cambridge, England). Nuovo cimento (10) 3, 424-9(1956) Feb. (In English).

A relation is derived which connects the real part of the non forward meson-nucleon scattering amplitude, to its imaginary part. (auth)

6904

PRODUCTION OF A HYPERFRAGMENT BY CAPTURE OF A NEGATIVE HYPERON. Ph. Rosselet, R. Weill, and M. Gailloud (Ecole Polytechnique de l'Universite de Lausanne, France). Nuovo cimento (10) 3, 505-9(1956) Feb. (In French).

6905

ON THE IONIZATION LOSS OF FAST μ-MESONS. G. N. Fowler (Univ. of Manchester, England). Nuovo cimento (10) 3, 1316-36(1956) June.

The fluctuation in the ionization loss of fast μ mesons due to resonance effects is discussed in detail using a modification of Landau's method. Numerical results for oxygen, neon, and other inert gases are compared with experiment and it is concluded that most of the observed large fluctuation can be accounted for when atomic resonance effects are included and the effect of primary excitation loss on the phenomenon is taken into account. (auth)

6906

ON THE PRODUCTION OF HEAVY MESONS IN THE NUCLEON-NUCLEON COLLISIONS AT ENERGIES NEAR THE THRESHOLD. P. Brovetto and S. Ferroni (Istituto Nazionale di Fisica Nucleare, Torin). Nuovo cimento (10) 3, 1387-93(1956) June.

Calculations based on the statistical theory are made for the production of pions and heavy mesons in nucleon-

nucleon collision energies below 10 Bev in the laboratory system. Multiplicities are derived as functions of energy, and the energy spectra for the various kinds of particles are given. Average multiplicities as a function of the energy spectrum of the protonic component in cosmic radiation are also given. (auth)

6907

EXCLUSION PRINCIPLE INHIBITION OF BOUND HYPERON MESONIC DECAY. H. Primakoff (Washington Univ., St. Louis, Mo. and Oxford Univ., England). Nuovo cimento (10) 3, 1394-9(1956) June.

An explanation is given of the variation with A, Z, of the ratio of the probabilities of mesonic to nonmesonic decay of hyperfragments and the mean life of the hyperfragments. The explanation involves an exclusion principle inhibition of the bound hyperon mesonic decay. Some evidence is presented in favor of a Λ^0 hyperon spin and parity (relative to a nucleon) of $\frac{1}{2}^-$ (or less probably, of $\frac{1}{2}^+$ or $\frac{3}{2}^+$) (*). (auth)

6908

TWO EXAMPLES OF RARE K^+-DECAYS IN EMULSION. R. Cester, T. F. Hoang, M. F. Kaplon, and G. Yekutieli (Univ. of Rochester, N. Y.). Nuovo cimento (10) 3, 1471-3 (1956) June.

The following K^+ decays were observed in stripped emulsions which had been exposed to the focused K^+ beam of the Brookhaven cosmotron: $K^+_{\pi 2} \rightarrow \pi^+ + \pi^0 (\rightarrow e^+ + e^- + \gamma)$, at rest, and $\tau^+ \rightarrow 2\pi^+ + \pi^-$, in flight. (C.W.H.)

6909

STATISTICAL FLUCTUATION IN THE CALCULATIONS OF PARTICLE GROUPS IN NUCLEAR EMULSION VOIDS. G. Lovera (Istituto di Fisica dell'Universita, Modena). Nuovo cimento (10) 3, 1476-8(1956) June. (In Italian).

6910

NOTE ON THE ANGULAR CORRELATION IN THE DECAYS OF HYPERFRAGMENTS. P. Zielinski (Polish Academy of Sciences, Warsaw). Nuovo cimento (10) 3, 1479-80(1956) June.

6911

INTERACTIONS OF K^+ MESONS WITH HYDROGEN NUCLEI AT 50 TO 110 MEV. N. N. Biswas, L. Ceccarelli-Fabbrichesi, M. Ceccarelli, M. Cresti, K. Gottstein, N. C. Varshneya, and P. Waloschek (Max-Planck-Institut für Physik, Göttingen). Nuovo cimento (10) 3, 1481-5(1956). June.

6912

INTERACTIONS OF K^- PARTICLES. A. J. Herz, R. M. May, J. H. Noon, B. J. O'Brien, and N. Solntseff (Univ. of Sydney, Australia). Nuovo cimento (10) 3, 1491-3(1956) June.

6913

INVESTIGATION OF THE PROTON-PROTON INTERACTION AT HIGH ENERGIES. M. G. Mescerjakov, N. P. Bogacev, and B. S. Neganov (Institute of Nuclear Problems, Academy of Sciences of the U.S.S.R., Moscow). Nuovo cimento (10) 3, Suppl. No. 1, 119-32(1956). (In English)

Results of the investigation of (p,p) collisions in the energy region from 460 to 666 Mev were reported. In the region the (p,p) interaction includes elastic scattering and meson production. (F.S.)

6914

PROPORTIONAL COUNTER MEASUREMENTS OF π-MESONIC X-RAYS FROM BERYLLIUM. D. West and E. F. Bradley (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (8) 1, 97-100(1956) Jan.

The experimental arrangement, counting methods, and results of π meson x rays from Be and F are given. Proportional counter use improved energy resolution by a factor of 6 over scintillation counting. (D.E.B.)

6915

MODEL FOR MULTIPLE MESON PRODUCTION. E. M. Henley (Univ. of Washington, Seattle) and T. D. Lee (Columbia Univ., New York). Phys. Rev. 101, 1536-47(1956) Mar. 1.

A model is presented for the multiple production of mesons. It is similar to that of Lewis, Oppenheimer, and Wouthuysen, but treats the spins and isotopic spins of the colliding nucleons as quantum mechanical operators. To illustrate the method, detailed calculations are carried out for a symmetrical scalar meson theory. (auth)

6916

BRANCHING RATIO FOR ALTERNATIVE MODES OF DECAY OF HYPERONS AND θ^0 MESONS. Gyo Takeda (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 101, 1547-51(1956) Mar. 1.

Restrictions upon the branching ratios of different decay modes of Σ^+, Λ^0, and θ^0 imposed by the invariant property of a system composed of nucleons, pions, hyperons, and heavy mesons under the Wigner time reversal are studied. These restrictions give upper and lower limits on the various branching ratios. A more or less specific model of hyperons and θ mesons is used in order to get other possible restrictions on the branching ratios. These results are model-dependent, and subsequently provide a possible test of the model chosen. (auth)

6917

DECAY OF THE PI MESON. S. B. Treiman and H. W. Wyld, Jr. (Princeton Univ., N. J.). Phys. Rev. 101, 1552-7(1956) Mar. 1.

It is known experimentally that, relative to the normal pion decay mode $\pi \rightarrow \mu + \nu$, the branching ratios ρ and ρ_γ for the alternate decay modes $\pi \rightarrow e + \nu$ and $\pi \rightarrow e + \nu + \gamma$ are very small ($\rho, \rho\gamma \lesssim 5 \times 10^{-5}$). Whether these limits on the branching ratios are consistent with the idea that pion decay occurs through a universal Fermi interaction via disintegration into a virtual nucleon pair: $\pi \rightarrow$ virtual nucleon pair $\rightarrow \mu$ (or e) $+ \nu$ is investigated. A value for ρ consistent with the experiments can be obtained if the pseudoscalar coupling constant g_p in the universal Fermi interaction is small compared to the axial vector coupling constant g_A. An estimate of ρ_γ is made assuming that the photodecay occurs through the axial vector coupling, and it is found that there is probably no disagreement with experiment on this score. However, the photodecay can also occur through the tensor interaction (forbidden for $\pi \rightarrow \mu + \nu$ and $\pi \rightarrow e + \nu$). Using the experimental value $g_A / g_T \lesssim 0.02$ obtained from beta-decay experiments, $\rho_\gamma \lesssim 0.025$ is estimated, a result which is inconsistent with the experimental value. It is shown that the disagreement cannot be removed by using a linear combination of all possible Fermi couplings. An upper limit on g_p for beta decay, valid even in the absence of a universal Fermi interaction, is obtained. (auth)

6918

THEORY OF PHOTOMESON PRODUCTION AT LOW ENERGIES. G. F. Chew and F. E. Low (Univ. of Illinois, Urbana). Phys. Rev. 101, 1579-87(1956) Mar. 1.

The problem of photomeson production is re-examined using the static model of the pion-nucleon interaction. It is shown that an important part of the low-energy matrix element can be exactly expressed as a function of the scattering phase shifts and the static nucleon magnetic moments. It is argued that the remainder is quite accurately given by the usual Born approximation. Corrections to this result, within the framework of the "one-meson" approximation, are considered. (auth)

6919

HYPERFRAGMENT PRODUCTION. H. Überall (Cornell Univ., Ithaca, N. Y.). Phys. Rev. 101, 1612-13(1956) Mar. 1.

A model is proposed for describing some of the features of Λ^0 production in nuclei of $Z \geq 3$. (D.E.B.)

6920

INTERACTION OF POSITIVE K-MESONS. Joseph E. Lannutti, Warren W. Chupp, Gerson Goldhaber, Sulamith Goldhaber, Ehsan Helmy, and Edwin L. Iloff (Univ. of California, Berkeley) and Aihud Pevsner and David M. Ritson (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 101, 1617-18(1956) Mar. 1.

Elastic, inelastic, and charge-exchange interactions of K^+ mesons have been observed in nuclear emulsion studies with the Bevatron. The angular distribution of 60 interactions in the energy range 30 to 120 Mev is tabulated. (D.E.B.)

6921

SOME REMARKS ON THE REACTION $K^- + d \rightleftharpoons \Sigma^- + p$. Kazuhiko Nishijima (Osaka City Univ., Japan). Progr. Theoret. Phys. (Japan) 14, 523-6(1955) Dec.

Recently Lee has suggested that the reaction $K^- + d \rightleftharpoons \Sigma^- + p$ might lend itself to a determination of the spins of the negative K meson and negative Σ particle. Because of the mysterious degeneracy of the mass levels of heavy mesons, however, the application of the detailed balancing arguments is not so simple as was the case with the positive pion unless heavy mesons with different names represent the competing modes of decay of a single kind of heavy meson. A possible experimental method to determine the spins of the negative K meson and negative Σ particle from the observation of the process $K^- + d \rightleftharpoons \Sigma^- + p$ by using a K meson beam. (auth)

6922

ON THE INTERACTION BETWEEN HYPERONS AND NUCLEONS AND THE HYPERFRAGMENTS. Kazuhiko Nishijima (Osaka City Univ., Japan). Progr. Theoret. Phys. (Japan) 14, 527-34(1955) Dec.

Based on the principle of charge independence and the experimentally established evidences for the existence of the hyperfragment ^3H, the nature of the force between a Λ^0 particle and a nucleon is investigated. It is shown that the range of the Λ-N force cannot be longer than half the pion Compton wave length and that its well depth parameter is larger than about 0.4. This result suggests the possible existence of the so-called hyper di-nucleons. The mechanism of the non-mesonic decays of a hyperfragment ^4He is investigated. A qualitative argument leads to the conclusion that the spin of the Λ^0 particle cannot be larger than $\frac{1}{2}$. (auth)

Refer also to abstracts 6795, 6958, 7034, 7035, and 7101.

METEOROLOGY

6923

MEANING OF DEUTERIUM ABUNDANCE IN METEORITES. Giovanni Boato (Istituto Fisico dell'Università, Genova). Nature 177, 424-5(1956) Mar. 3.

The significance of the deuterium content in meteorites in relation to the origin of the solar system is discussed. It was not possible to obtain the exact isotopic composition of the primordial hydrogen from the existing data. (C.W.H.)

MICROWAVES

6924 NP-5899

Columbia Univ., New York. Columbia Radiation Lab.
FURTHER ASPECTS OF THE THEORY OF THE MASER. Special Technical Report [on] RESEARCH INVESTIGATION DIRECTED TOWARD EXTENDING THE USEFUL RANGE OF THE ELECTROMAGNETIC SPECTRUM. K. Shimoda, T. C. Wang, and C. H. Townes. Mar. 1, 1956. 41p. DA Project No. 3-99-10-022; SC Project No. 102B. Contract DA-36-039-SC-64630. (CU-1-56-SC-64630 Phys.)

The theory of the molecular transitions which are induced by the microwave field in a maser and the effects of various design parameters are examined in detail. It is shown that the theoretical minimum detectable beam intensity when the maser is used as a spectrometer for the 3-3 line of NH_3 is about 10^9 molecules/sec under typical experimental conditions. Various systematic frequency shifts and random frequency fluctuations of the maser oscillator are discussed and evaluated. The most prominent of the former are the "frequency-pulling" effect which arises from detuning of the cavity and the Doppler shift due to the asymmetrical coupling of the beam with the two travelling wave components of the standing waves which are set up in the cavity. These two effects may produce fractional shifts as large as one part in 10^9. If adequate precautions are taken, however, they can be reduced to one part in 10^{10} or possibly less. The random fluctuations are shown to be of the order of one part in 10^{13} under typical operating conditions. For molecular beams in which the electric-dipole transition is used the TM_{010} mode is usually the most suitable for the maser while in atomic beams in which magnetic transitions are utilized, the TE_{011} mode is to be preferred. (auth)

MOLECULAR PROPERTIES

6925 ATI-111187

Ohio State Univ., Columbus. Cryogenic Lab.
COEFFICIENTS OF THERMAL EXPANSION OF SOLIDS AT LOW TEMPERATURES. I. THE THERMAL EXPANSION OF COPPER FROM 15° TO 300°K. Technical Report No. 11 [on] LIQUID HYDROGEN AS AN AIRCRAFT FUEL. Thor Rubin, H. W. Altman, and H. L. Johnston. [1952?]. 23p. Contract W33-038-ac-14794(16243). (TR-264-11).

An apparatus for measuring the thermal expansion of solids over the temperature range 15 to 300°K by a differential method making use of a Fizeau interferometer is described. Experimental data for Cu are presented and are applied to the Grüneisen relations. (auth)

NEUTRONS

6926 AERE-RP/M-79

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
CALIBRATION OF A SPONTANEOUS FISSION NEUTRON SOURCE. R. Richmond. May 1, 1956. 5p.

A Pu^{240} source was compared with the Oxford Rd-Th-D_2O source and the Durham Ra-γ-Be sources for calibration. For an added calibration a comparison was also obtained using the Harwell and Basel sources. The strength of the source found by comparison with the others was $1.99 \pm 0.04 \times 10^4$ neutrons per second. The calculated output of the source from spontaneous fission rate and neutron yield per fission of Pu^{240} agreed with the measured value to within a few percent. (F.S.)

6927 AERE-RP/R-1942

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.
THE DEPENDENCE OF FAST NEUTRON ATTENUATION IN PORTLAND CONCRETE ON ITS HYDROGEN CONTENT. J. A. Dyson and J. R. Harrison. Apr. 11, 1956. 9p.

Effects of varying the H content in a typical Portland concrete on the attenuation of fast (>1 Mev) neutrons has

been investigated using the theory developed by Spinney. It is shown that increasing the H content from 0.1% to 1% (by weight) changes the asymptotic length from 10.6 to 8.9 cms. (auth)

6928 NDA-12-16

Nuclear Development Corp. of America, White Plains, N. Y.

NEUTRON CROSS SECTION DATA FOR CARBON. M. Kalos and H. Goldstein. Mar. 31, 1956. 13p. For Oak Ridge National Lab. Contract [W-7405-eng-26], Subcontract 394. $3.30(ph OTS); $2.40(mf OTS).

A tabulation is made of total and elastic scattering cross sections together with Legendre coefficients for elastic angular distributions for neutron scattering by carbon, in the range 0.33 to 18.0 Mev. (auth)

6929 WAPD-114

Westinghouse Electric Corp. Bettis Plant, Pittsburgh.

NEUTRON SLOWING DOWN IN GROUP DIFFUSION THEORY. R. L. Hellens. May 1956. 88p. Contract AT-11-1-GEN-14. $0.50.

The two group theory of neutron diffusion in hydrogeneous reactors has received increased emphasis for nuclear core design in the past several years as a means of evaluating core characteristics throughout lifetime. The present report deals with the specification of two-group theory and with methods of generating group parameters in a systematic way. The results available are presented; of particular interest are the problems associated with slightly enriched U^{235} in U^{238} systems. (auth)

6930

THE SCATTERING OF HIGH ENERGY NEUTRONS BY A COULOMB FIELD. R. G. P. Voss and R. Wilson (Clarendon Lab., Oxford, England). Phil. Mag. (8) 1, 175-85(1956) Feb.

A polarized beam of 100-Mev neutrons was obtained from the A.E.R.E. cyclotron; this was scattered from U at sufficiently small angles that there is an appreciable scattering from the interaction of the magnetic moment of the neutron with the Coulomb field. The scattering and polarization of the Coulomb field scattering are in agreement with theory, and enable a value for the sign and magnitude of the polarization of the neutron beam to be obtained. (auth)

6931

ENERGY OF THE DELAYED NEUTRONS FROM THE FISSION OF U^{235}. T. W. Bonner, S. J. Bame, Jr. and J. E. Evans (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 101, 1514-15(1956) Mar. 1.

The energy distribution of neutrons from the short-lived neutron emitters produced in the thermal fission of U^{235} has been determined with a cloud chamber. A continuous energy distribution was obtained with a maximum number of neutrons at the lowest energies and a few neutrons with energies of at least 2.4 Mev. A linear plot of (number of neutrons)$^{1/2}$ vs. the neutron energy is obtained indicating an extrapolated neutron energy of 3.5 Mev. (auth)

6932

DETERMINATION OF ABSOLUTE YIELD FROM NEUTRON SOURCES. M. A. Bak, K. A. Petrzhak, and Yu. F. Romanov. Uspekhi Fiz. Nauk 58, 667-84(1956) Apr. (In Russian)

A review is given of works published up to 1955 on the question of determining the absolute number of neutrons emitted per sec by neutron sources. Results of the works are completely tabulated giving the comparative data on the type of sources, quantity of Ra or Rn, and the Be absorbers, the type of detectors, and the neutron yield from the Rn + Be and Ra + Be sources. (R.V.J.)

6933

COINCIDENCE ARRANGEMENT FOR THE PRODUCTION OF MONOCHROMATIC NEUTRONS BY THE d-d REACTION. W. Franzen, P. Huber, and L. Schellenberg (Univ. of Basel, Switzerland). Z. Naturforsch. 10a, 820-5(1955) Nov. (In German)

6934

EXPERIMENTAL INVESTIGATION OF NEUTRON-NUCLEON AND NEUTRON-DEUTERON INTERACTION IN THE ENERGY REGION 380-590 MEV. V. P. Dzhelepov, Yu. M. Kazarinov, B. M. Golovin, V. B. Fljagin, and V. I. Satarov (Institute of Nuclear Problems of the Academy of Sciences of the U.S.S.R., Moscow). Nuovo cimento (10) 3, Suppl. No. 1, 61-79(1956). (In English)

Data on the nuclear interaction of particles in antisymmetric states were obtained from experimental scattering data of identical nucleons. Elastic scattering data of (n,p) and (n,d) reactions were investigated. (F.S.)

6935

A SIMPLE MEASUREMENT OF THE ABSOLUTE YIELDS OF NEUTRON SOURCES. P. Jensen, H. P. Terfloth, and H. Averdung (Univ. of Freiburg, Germany). Z. Naturforsch. 10a, 825-31(1955) Nov. (In German)

Refer also to abstract 7029.

NUCLEAR PHYSICS

6936

REACTOR PHYSICS. I. NEUTRONS AND THEIR REACTIONS WITH MATTER. James F. Hill (Reactor School, Harwell, Berks, England). Nuclear Power 1, 32-8(1956) May.

Basic facts of nuclear physics necessary for an understanding of the processes which take place in a reactor are first presented. This is followed by a statement of the arguments which lead to the possibility of maintaining a chain reaction by means of a reactor. (auth)

6937

ON A BILOCAL INTERPRETATION OF ISOTOPIC SPIN. J. Rayski (Nicolas Copernicus Univ., Torun, Poland). Nuovo cimento (10) 3, 126-30(1956) Jan. (In English)

The systematization of elementary particles given is complementary to that of Gell-Mann. Arguments against the existence of an isotopic spin space are given. The isotopic spin seems to be explicable within the framework of the bilocal field theory without necessity of increasing the number of dimensions of the physical space. (auth)

6938

A POSSIBLE EXAMPLE OF PRODUCTION AND ANNIHILATION OF AN ANTIPROTON. M. Teucher and H. Winzeler (Physikalisches Institut der Universität, Bern) and E. Lohrmann (Hochspannungslaboratorium Hechingen). Nuovo cimento (10) 3, 228-30(1956) Jan. (In English)

6939

ON THE OBSERVATION OF AN ANTIPROTON STAR IN EMULSION EXPOSED AT THE BEVATRON. O. Chamberlain, W. W. Chupp, G. Goldhaber, E. Segrè, and C. Wiegand (Univ. of California, Berkeley) and E. Amaldi, G. Baroni, C. Castagnoli, C. Franzinetti, and A. Manfredine (Istituto di Fisica dell'Università, Rome). Nuovo cimento (10) 3, 447-67(1956) Feb. (In English).

In connection with the antiproton investigation at the Bevatron several stacks of nuclear emulsions have been exposed in a magnetically selected beam of negative particles. The selected particles were produced in a copper target, bombarded with protons of 6.3 Bev, and had a momentum of 1.09 Bev/c. The experiments were designed to observe the annihilation process undergone by an antiproton brought to rest inside the emulsion. The details of the investigation

are given. An estimate is given of the number of expected annihilation stars as obtained from previous measurements with counter experiments reported by Chamberlain, Segre, Wiegand and Ypsilantis. The description of the only event found so far is given. The mass of the primary particle responsible for it, as obtained from a weighted average using several independent methods is (1824±51) m_e. The star produced by it, is associated with a minimun release of «visible» energy of ~826 Mev while the corresponding unbalanced «visible» momentum amounts to ~520 Mev/c. (auth)

6940

ABOUT THE CAPTURE AND ANNIHILATION OF ANTIPROTONS. R. Gatto (Istituto di Fisica dell'Università, Rome). Nuovo cimento (10) 3, 468-72(1956) Feb. (In English).

The mechanism of annihilation of antiprotons is discussed. It is shown that large multiplicities for the number of pions emitted should be infrequent, and some considerations are reported concerning the average number of neutral pions to be expected. It is suggested that a K-$\bar{K}$ pair could also be emitted. An event recently found and interpreted as due to the annihilation of an antiproton is discussed, and it is shown that, using Gell-Mann's model, arguments, can be given against its interpretation in terms of a new long-lived heavy boson. (auth)

6941

THE OPTICAL MODEL APPLIED TO THE ELASTIC SCATTERING OF NUCLEONS BY VARIOUS LIGHT NUCLEI. E. J. Burge, Y. Fujimoto, and A. Hossain (Univ. of Bristol, England). Phil. Mag. (8) 1, 19-33(1956) Jan.

The optical model of the nucleus has been applied to the elastic scattering of 9.5 Mev protons by He, C, N, O, F, Ne and A, and 14 Mev neutrons by C, N and O. In general, fair agreement has been obtained for a square-well potential, but the results suggest that for higher energies and heavier nuclei a shaping of the well is necessary. By making the nuclear radius a variable parameter, instead of $1.45 \times A^{1/3} \times 10^{-13}$ cm, better agreement could probably be obtained. The mean free path of nucleons of these energies in nuclear matter is found to be larger than the nuclear radius. No simple relation was found between the depth of the potential-well and the atomic weight. (auth)

6942

ANOMALOUS MAGNETIC MOMENT OF THE NUCLEON AND THE PION-NUCLEON SCATTERING. H. Miyazawa (Institute for Advanced Study, Princeton. N. J.). Phys. Rev. 101, 1564-9(1956) Mar. 1.

The anomalous magnetic moment of the nucleon is calculated using the method developed by Chew and Low. The static model is used, i.e., recoil and nucleon pair creation are omitted. The anomalous moments are expressed exactly in terms of the renormalized coupling constant and pion-nucleon scattering cross sections. The result shows a satisfactory agreement for the magnetic moment arising from the pion current. The contribution from the nucleon current, however, turns out to be too large. It is concluded that the Sachs' mirror condition cannot be satisfied with the simple static model. (auth)

6943

EFFECTIVE-RANGE APPROACH TO THE LOW-ENERGY p-WAVE PION-NUCLEON INTERACTION. G. F. Chew and F. E. Low (Univ. of Illinois, Urbana). Phys. Rev. 101, 1570-9(1956) Mar. 1.

The theory of p-wave pion-nucleon scattering is reexamined using the formalism recently proposed by one of the authors (F.E.L.). On the basis of the cut-off Yukawa theory without nuclear recoil it is found, for not too high values of the coupling constant, that: (a) For each p-wave phase shift a certain function of the cotangent should be approximately linear at low energies and should extrapolate to the Born approximation at zero total energy. The value of the renormalized unrationalized coupling constant determined in this way from experiment is $f^2 = 0.08$. A special feature of the predicted energy dependence of the phase shifts is that δ_{33} is positive and the other p phase shifts are negative. (b) The so-called "crossing theorem" requires a relation between the four p phase shifts, so that in addition to the coupling constant only two further constants are needed to completely specify the low-energy behavior. (c) The direction of the energy variation in the (3,3) state is such that a resonance will occur for a sufficiently large cut-off ω_{max}. Rough estimates indicate that $\omega_{max} \approx 6$ will produce a resonance at the energy required by experiment. It is argued that the results (a) and (b) are very probably also consequences of a relativistic theory but that (c) may not be. (auth)

6944

INFLUENCE OF "NEW UNSTABLE PARTICLES" ON THE ELECTROMAGNETIC PROPERTIES OF NUCLEONS. G. Sandri (Massachusetts Inst. of Tech., Cambridge). Phys. Rev. 101, 1616-17(1956) Mar. 1.

The new "particles" tend to neutralize the charges and currents in the neutron self-field and enhance those in the proton self-field. This is used as an explanation of electron-neutron interaction phenomena. (D.E.B.)

6945

THE RELATIVISTIC AND EXCHANGE CURRENT CORRECTIONS TO THE DEUTERON MAGNETIC MOMENT AND THE THERMAL N-P CAPTURE CROSS SECTION. Masao Sugawara (Royal Inst. of Tech., Stockholm, Sweden). Progr. Theoret. Phys. (Japan) 14, 535-50(1955) Dec.

Starting from the symmetrical ps meson theory, the relativistic and exchange current corrections to the thermal n−p capture cross section and the deuteron magnetic moment are defined unambiguously and calculated using the t−d formalism up to the lowest order of the meson-nucleon coupling constant and the nucleon velocity. This work is a refinement and generalization of the previous paper on the exchange current correction to the deuteron moment, the result of which is also obtained here. With respect to the relativistic corrections, quite a different method is used. Numerical values of these corrections are then estimated by using the phenomenologically adjusted two nucleon wave functions with or without the hard core. The sum of these corrections is shown to be about +1% of the capture cross section and about −2% of the magnetic moment. The phenomenological thermal n−p capture cross section is also estimated and is shown to agree with the experimental one within much larger experimental and theoretical ambiguities than the above correction. As the exchange current correction is reduced very much if the D-state probability is chosen to be smaller and there may be in addition some small positive non-additivity correction, the deuteron D-state probability is finally estimated as 3±1% or so, the same value as was reported previously. (auth)

6946

LOW ENERGY LIMITS OF PHOTON-NUCLEON AND PION-NUCLEON COLLISIONS. Sigeo Hanawa (Tokyo Gakugei Univ.), Mikio Namiki (Waseda Univ., Tokyo), and Shin Chiba (Tokyo Univ. of Education). Progr. Theoret. Phys. (Japan) 14, 551-79(1955) Dec.

Low energy limits of photon-nucleon and pion-nucleon collisions are investigated on the basis of the approximation which neglects higher order terms with respect to the pion-nucleon mass ratio but includes the radiative corrections to an arbitary order in the coupling constants. It is shown that, near threshold, all the radiative corrections to the processes, $\pi + n \rightarrow n + 2\pi$ and $\gamma + n \rightarrow n + 3\pi$, can be concealed into the

nucleon mass, the electric charge, the mesic charge and the Matthews' constant renormalized in accordance with the conventional prescription, provided that the renormalized Matthews' constant is of the same order of magnitude as or larger than the renormalized coupling constant for the pion-nucleon interaction. It is suggested that these processes may serve the experimental determination of the Matthews' constant and the test of validity of the ps(ps) theory. As preliminaries for these arguments, Thirring's and Kroll and Ruderman's theorems on the low energy Compton scattering and the thershold photomeson production are reviewed, taking account of these terms which have been omitted in the original works, and effective charges are introduced for pion-nucleon scattering and two-gamma decay of a neutral pion. It is noted that the results are unaffected by virtual processes caused by heavy mesons obeying the "even-odd" rule proposed by Pais. (auth)

6947

MESON-THEORETICAL POTENTIALS IN N^{14}. Shoichiro Otsuki, Tatsuro Sawada, and Syota Suekane (Kyoto Univ., Japan). Progr. Theoret. Phys. (Japan) 14, 606-7(1955) Dec.

Theoretical curves of N^{14} levels are plotted for $1/\sqrt{\nu} = 2.4 \times 10^{-13}$ and 3.0×10^{-13} cm. The level ordering is the same in both cases, but the level spacing is larger for $1/\sqrt{\nu} = 2.4 \times 10^{-13}$ cm. The experimental level spacing lies between these two values. μ and Q are also plotted and jj coupling limits given. (D.E.B.)

NUCLEAR PROPERTIES

6948 LA-2016

Los Alamos Scientific Lab., N. Mex.

NEUTRON CROSS SECTIONS. H. J. Longley. Mar. 1956. 227p. Contract W-7405-eng-36. $1.25(OTS).

Information about neutron cross sections obtained from a complex square well, from experimental data, and from a comparison of the two is contained. Data on angular distributions which can be used to make calculations by Monte Carlo methods, by diffusion methods, and by straightforward integration are presented for the energy range from 1 to 14 Mev. (auth)

6949

A SPECTROMETER FOR HIGH RESOLUTION NUCLEAR MAGNETIC RESONANCE EXPERIMENTS. G. Lindström and B. N. Bhar. Arkiv Fysik. 10, No. 6, 489-99(1956).

An apparatus for high resolution nuclear magnetic resonance experiments for the studies of "chemical shift" and other details of the nuclear resonance lines in liquids is described with detailed procedures, experimental technique and design of the radio-frequency bridge and permanent magnet used. The origin of the "chemical shift" and fine components of nuclear magnetic resonance spectra is also discussed. Bloch's method of "line-narrowing" by macroscopic motion of the sample is utilized to observe the splitting of nuclear resonance lines originating from electron-coupled spin-spin interaction of non-equivalent protons in ethyl alcohol. The resolution of the apparatus is at present of the order of one part in 10. (auth)

6950

SOME BROMINE, IODINE, AND INDIUM NUCLEAR QUADRUPOLE INTERACTION FREQUENCIES. G. W. Ludwig (Harvard Univ., Cambridge, Mass.). J. Chem. Phys. 25, 159-71(1956) July.

Quadrupole interaction frequencies due to Br^{79} and I^{127} are reported in a number of crystalline solids. Br^{79} interaction frequencies in bromobenzene derivatives and I^{127} frequencies in iodobenzene derivatives are correlated with Hammett's σ. The splitting between interaction frequencies found in s-tribromophenol and related di- and tribromobenzene derivatives is explained tentatively on the basis of hindered rotation. Coupling constants and asymmetry parameters for I^{127} in iodobenzene derivatives are reported and discussed in terms of the single bond, double bond, and ionic character of the carbon-iodine bond. Owing to the large asymmetry (~45%) of the I^{127} quadrupole coupling in HIO_3, the $|\Delta m| = 2$ transition could be observed as well as the two $|\Delta m| = 1$ transitions. Eight interaction frequencies were found in InI_3, two of which (at 26.93 Mc/sec and 36.33 Mc/sec) are attributed to $(\pm 7/2 \leftrightarrow \pm 5/2)$ and $(\pm 9/2 \leftrightarrow \pm 7/2)$ transitions of In^{115}. From these two frequencies a coupling constant and asymmetry parameter of 219.8 ± 0.3 Mc/sec and 32.0 ± 4.0%, respectively, are evaluated for In^{115} in this compound. (auth)

6951

NUCLEAR MAGNETIC RESONANCE FIELD SHIFTS OF Si^{29} IN VARIOUS MATERIALS. G. R. Holzman, P. C. Lauterbur, John H. Anderson, and W. Koth (Mellon Inst., Pittsburgh). J. Chem. Phys. 25, 172-3(1956) July.

The variation of the magnetic field which defines exact resonance of the Si^{29} nucleus is shown for a variety of solid and liquid compounds. Measurements were made at room temperature and at a constant frequency of 8 Mc/sec using a Varian crossed coil and phase-sensitive detection apparatus. Three methods described were used to establish the resonant field. (auth)

6952

ON THE MAGNETIC ANISOTROPY OF FeF_2 AND CoF_2. Toru Moriya, Kazuki Motizuki, Junjiro Kanamori, and Takeo Nagamiya (Osaka Univ., Japan). J. Phys. Soc. Japan 11, 211-25(1956) Mar.

The magnetic anisotropies of FeF_2 and CoF_2 are studied in detail by calculating the crystalline field acting on their magnetic ions and considering the effect of the spin-orbit coupling. The electronic energy level splittings of the ions Fe^{++} and Co^{++} in the crystalline field are calculated assuming first that all the surrounding ions are point charges and then taking account of the overlapping of their 3d electrons with the electron clouds of the surrounding fluorine ions. The spin-orbit coupling is then introduced and the g-values are calculated. Further, introducing the exchange coupling in the approximation of molecular field, the parallel and perpendicular susceptibilities of FeF_2 are calculated and a reasonable agreement with experiment is found. For CoF_2, however, the calculated level splitting is not successful in explaining the observed susceptibilities. Discussions are given on the possible sources of this disagreement and the nature of the approximations made in this study. (auth)

6953

PHOTODISINTEGRATION OF SAMARIUM. E. Silva and J. Goldemberg (Universidade de São Paulo, Brazil). Nuovo cimento (10) 3, 12-15(1956) Jan. (In English)

In order to study the photodisintegration of Sm induced by irradiation with x rays, discs of pressed Sm_2O_3 were exposed to x rays from the 22-Mev betatron of the Laboratorio de Fisica Nuclear of the University of São Paulo. (auth)

6954

β-γ ANGULAR CORRELATION OF $^{214}_{83}Bi$. F. Demichelis (Istituto di Fisica Sperimentale del Politecnico, Torin) and L. A. Radicati (Istituto di Fisica dell'Universitã, Napoli). Nuovo cimento (10) 3, 152-9(1956) Jan. (In English)

The angular correlation between the β transition (2.56 Mev) originating from the ground state of Bi^{214} and the γ ray (0.61 Mev) to the ground state of Po^{214} has been measured. From the knowledge of the log ft values of the two β transitions (2.56 Mev and 3.17 Mev) originating from Bi^{214} and the measurement of the angular correlation coefficient, the value 2- is deduced for the spin and the parity of the ground state of Bi^{214}. (auth)

6955
A MEASUREMENT OF THE DIRECTION OF THE POLARIZATION PRODUCED IN THE SCATTERING OF 135 MEV PROTONS. M. J. Brinkworth and B. Rose (Atomic Energy Research Establishment, Harwell, Berks, England). Nuovo cimento (10) 3, 195-202(1956) Jan. (In English)

The 135-Mev polarized proton beam, obtained from the Harwell cyclotron by scattering to the left from carbon, has been slowed down to give protons of energy less than 10 Mev, and these protons have then been scattered by helium. The ratio of the intensities scattered at the same angle to left and right of the incident beam has been measured with photographic plates. This ratio, together with a phase shift calculation of the polarization produced in proton-helium scattering, gives the direction of the polarization produced in the first scattering. The observed direction agrees with that predicted theoretically on the assumption that the spin-orbit interaction in high energy nuclear scattering is the same as in the shell model of the nucleus. (auth)

6956
EXPERIMENTAL MEASUREMENTS OF DOUBLE COMPTON EFFECT. A. Bracci, C. Coceva, L. Colli, and R. Dugnani Lonati (Laboratori CISE, Milan). Nuovo cimento (10) 3, 203-13(1956) Jan. (In English)

The cross section of the double Compton effect in the particular case of incident γ rays of ~ 1 Mev energy and of scattered γ rays making an angle of 90° throughout with each other and with the incident γ, has been experimentally measured, and the energy distribution of the scattered γ has been observed. The scattered γ rays are detected by means of two scintillation spectrometers which use sodium iodide crystals and EMI photomultipliers working in coincidence. The pair of pulses from the photomultipliers, corresponding to γ rays which give rise to a coincidence, are sent to a cathode-ray tube on whose screen they are photographed and then analyzed. Experimental results obtained in the present work, regarding both the cross-section value and the energy distribution, are in good agreement with the theoretical ones calculated by Mandl and Skyrme. (auth)

6957
ON THE INELASTIC SCATTERING OF ELECTRONS FROM ^{12}C. G. Morpurgo (Scuola di Perfezionamento in Fisica Nucleare dell'Università, Rome). Nuovo cimento (10) 3, 430-7(1956) Feb. (In English).

The theoretical interpretation of Fregeau and Hofstadter's experiment on the elastic and inelastic scattering of high energy electrons from C^{12} is discussed; the excitation of the 4.43 Mev level is particularly considered, and the increased of the ratio $d\sigma_{inelastic}/d\sigma_{elastic}$ with the energy is explained as well as the constancy of $d\sigma_{inelastic}$ in the interval 80 to 187 Mev. Calculations are performed with the use of an oscillator shell model both in LS and JJ coupling. The quantitative agreement is satisfactory and better (by a factor of three) with LS than with JJ coupling. (auth)

6958
ABOUT THE A^0-NUCLEON FORCE. R. Gatto (Istituto di Fisica e Scuola di Perfezionamento in Fisica Nucleare dell'Università, Rome). Nuovo cimento (10) 3, 499-502(1956) Feb. (In English).

6959
AN ELECTRON RECOIL STUDY OF THE GAMMA SPECTRA OF ^{124}Sb, ^{59}Fe, ^{110}Ag, ^{64}Cu, ^{192}Ir, ^{140}La, AND ^{198}Au. B. S. Dzhelepov and Ju. V. Hol'nov (Academy of Sciences of the U.S.S.R., Moscow). Nuovo cimento (10) 3, Suppl. 1, 49-53 (1956). (In English)

An apparatus "riton" used to investigate γ-ray spectra is described. Energy calibrations were made with γ rays of accurately known energies and the spectral sensitivity was checked with the Na^{24} lines. The spectra of the radioactive substances were investigated and compared with those obtained in earlier experiments. (F.S.)

6960
THE RaC γ-RAY SPECTRUM. B. S. Dzhelepov and S. A. Sestopalova (Academy of Sciences of the U.S.S.R., Moscow). Nuovo cimento (10) 3, Suppl. No. 1, 54-60(1956). (In English)

The modifications made to the gamma spectrometer (ritron) to reduce the halfwidth of the lines and to permit the separation of the spectrum into its components are described. The modified instrument is called an elotron. The experimental curve obtained for the RaC γ spectrum and the correction made are discussed. (See Nuovo cimento (10) 3, Suppl. No. 1, 49-53(1956).) (F.S.)

6961
INVESTIGATION OF PHOTOPROTONS FROM COPPER AND NICKEL. E. Lejkin, R. Osokina, and B. Ratner (Academy of Sciences of the U.S.S.R., Moscow). Nuovo cimento (10) 3, Suppl. No. 1, 105-18(1956). (In English)

Photonuclear reactions were studied to establish the mechanism of γ-ray interaction with nuclei and to provide a check for the validity of proposed nuclear models. The energy and angular distribution of photoprotons from neighboring Cu and Ni nuclei at maximum values of bremsstrahlung energy were observed in detail. (F.S.)

6962
RADIATIVE TRANSITIONS IN LIGHT ELEMENTS. II. D. H. Wilkinson (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phil. Mag. (8) 1, 127-52(1956) Feb.

A survey is presented of present knowledge concerning radiative transitions in nuclei of $A \leq 20$. Over a hundred transitions, chiefly dipole, are analysed in terms of the Weisskopf units, and the following chief conclusions are drawn: El transitions have a most probable speed of about 0.032 Weisskopf units with a spread in speed of about a factor of seven either way; the corresponding quantities for Ml transitions are a speed of 0.015 Weisskopf units and a spread of a factor of 20 either way; these distributions are consistent with shell model expectations; if a transition shows $\Gamma_\gamma(ev)/E_\gamma^3$ (Mev)>0.02, then it is very probably El; there is no clear dependence of transition speed on level spacing or other feature; and, some of the higher multipole transitions are inconsistent with shell model expectation and give evidence of collective motion. (auth)

6963
ANGULAR CORRELATION MEASUREMENTS ON ^{88}Sr. C. F. Coleman (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (8) 1, 166-74(1956) Feb.

Three semi-circular focusing spectrometers, making use of a common magnetic field, have been used to measure the angular correlation of the internal conversion electron pairs produced in the decay of the 1.85 Mev state of Sr^{88}. The results support the assignment 2+ for this state. Similar equipment has been used to measure the angular correlation of certain conversion electron cascades. With a polarimeter having good energy resolution, direction-polarization measurements have been carried out on the 0.90, 1.85 Mev gamma-ray cascade in Sr^{88}. These show that the 1.85 and 2.75 Mev levels in this nucleus have even and odd parity respectively. (auth)

6964
ERRATA: PRESSURE-VOLUME ISOTHERMS OF He^4 BELOW 4.2°K. William E. Keller. Phys. Rev. 100, 1790 (1955) Dec. 15. (See NSA 9-1907).

6965
LEVELS OF Al^{25} FROM THE $Mg^{24}(p,\gamma)Al^{25}$ REACTION. D. S. Craig (Atomic Energy of Canada Ltd., Chalk River, Ont.). Phys. Rev. 101, 1479-84(1956) Mar. 1.

At the 222-kev resonance in the reaction $Mg^{24}(p,\gamma)Al^{25}$, a 2.05 ± 0.02-Mev γ ray in cascade with one of 0.454 ± 0.005 Mev, and a 1.56 ± 0.03-Mev γ ray in cascade with one of 0.97 ± 0.03 Mev have been observed. The intensities of the 2.05, 1.56, and 0.97-Mev γ rays are in the ratio of 100:14:5. The 2.05-Mev γ rays have a thick target yield of $(1.0 \pm 0.5) \times 10^{-11}$ γ/p, and exhibit an isotropic angular distribution with respect to the bombarding beam. The width at half-maximum of the resonance is less than 2 kev. The level in Al^{25} formed at the 222-kev resonance has an energy of 2.50 ± 0.02 Mev, and a spin and parity of $\frac{1}{2} \pm$ or $\frac{3}{2} +$, with the latter being a less probable assignment. (auth)

6966

EXCITATION OF SOME LOW-LYING LEVELS BY INELASTIC NEUTRON SCATTERING. Janet B. Guernsey and A. Wattenberg (Massachusetts Inst. of Tech, Cambridge). Phys. Rev. 101, 1516-23(1956) Mar. 1.

The de-excitation gamma radiation following inelastic scattering of neutrons has been studied for eight elements (of normal isotopic abundance) with excited states between 100 and 350 kev. A thin NaI(Tl) crystal spectrometer is used as a gamma-ray detector. Yield curves for the gamma rays from low-lying levels in Mn, I, Hf, Ta, W, Re, Pt, and Au have been obtained as a function of neutron energy for neutrons from 100 to 1800 kev. In some cases these yield curves represent a composite of gamma radiation from the directly excited states under observation, and cascade radiation from higher excited states. A comparison of the yield with total inelastic scattering cross sections requires a complete knowledge of the decay schemes. This is discussed for the individual elements. In the cases of Mn, I, and Re cross-section values obtained represent that part of the total inelastic cross section which arises from the excitation of a single known level. Agreement of the excitation curves with Hauser-Feshbach theory is good in most cases. No large unanticipated effects seems to arise in the inelastic scattering of neutrons from levels known to be rotational. (auth)

6967

INELASTIC SCATTERING OF 42-MEV α's BY Mg. P. C. Gugelot and M. Rickey (Univ. of Washington, Seattle). Phys. Rev. 101, 1613-14(1956) Mar. 1.

Inelastic scattering of nucleons which leave the residual nucleus in an excited state is discussed. The differential cross section for the inelastic scattering of 42-Mev α particles to the 1.37-Mev level in Mg^{24} is plotted and compared with a plot of the elastic scattering cross section. (D.E.B.)

6968

INELASTIC SCATTERING OF 18-MEV PROTONS BY Mg^{24}. P. C. Gugelot and P. R. Phillips (Princeton Univ., N. J.) Phys. Rev. 101, 1614-15(1956) Mar. 1.

The differential cross section for inelastic scattering of 18-Mev protons to the 1.37 Mev level in Mg^{24} is plotted. These results are compared with published results on 10-, 9.6-, and 7.3-Mev protons. The rapid change in the differential cross section with incident proton energy is discussed. (D.E.B.)

6969

SHELL STRUCTURE EFFECTS ON SPONTANEOUS FISSION HALF-LIFE. R. E. Lingenfelter (Univ. of California, Los Angeles). Phys. Rev. 101, 1615-16(1956) Mar. 1.

At the neutron numbers 132 and 164, discrete fission is possible, resulting in fragments of N = 50 and 82. Fission in this region might be more energetic and nuclei in the region would be less stable to spontaneous fission, leading to a decrease in the spontaneous fission half life. This is experimentally indicated by a plot of spontaneous fission half lives. (D.E.B.)

6970

SPIN AND POLARIZATION EFFECTS IN THE ANNIHILATION OF TRIPLET POSITRONIUM. R. M. Drisko (Carnegie Inst. of Tech., Pittsburgh). Phys. Rev. 102, 1542-4(1956) June 15.

The annihilation rate of triplet positronium has been calculated without summing at once over spin and polarization. The results, quoted without proof, apply to some recent measurements of spin and polarization effects. (auth)

6971

K-CAPTURE BRANCH IN Tm^{170}. Paul P. Day (Argonne National Lab., Lemont, Ill.). Phys. Rev. 102, 1572-4(1956) June 15.

The electromagnetic spectrum resulting from the decay of Tm^{170} has been examined on a ten-inch bent-crystal spectrometer. One gamma ray, seven K x-rays, and one L x-ray were observed. The presence of Er K x-ray was established and shown to be due to a 0.15% K-capture branch in the decay of Tm^{170}. The energy of the first excited state of Yb^{170} was found to be 84.229 ± 0.041 kev. The reflectivity of the bent-topaz crystal used in the spectrometer was found to obey the function $(1/E)^{1.35 \pm 0.05}$. (auth)

6972

NEUTRON RESONANCES IN THE KEV REGION. John H. Gibbons (Duke Univ., Durham, N. C.). Phys. Rev. 102, 1574-9(1956) June 15.

A neutron collimation-detection system has been constructed for use in measurements of resonance neutron cross sections. The high efficiency of the detector in combination with careful collimator design enables one to collect data with relatively good resolution in a short time. Although designed to measure cross sections at a minimum energy of about 5 kev, resonances have been observed at energies as low as 350 ev. Resolving power exceeds that of velocity selectors, however, only at neutron energies greater than about 5 kev. Resonances in iron were found at 8, 29, 75, and 85 kev. The three latter resonances exhibit strong interference dips and are assumed to be due to s-wave neutrons on Fe^{56}. The resonance energies found in bismuth were 1, 3, 13, 16, 34, 47, and 70 kev; the level spacing for a single J value thus seems to be about 20 kev. (auth)

6973

NEUTRON RESONANCES IN THE KEV REGION: HEAVY EVEN ELEMENTS. Henry W. Newson, J. H. Gibbons, H. Marshak, R. M. Williamson, R. A. Mobley, A. L. Toller, and R. Block (Duke Univ., Durham, N. C.). Phys. Rev. 102, 1580-3(1956) June 15.

Neutron cross-section curves as a function of neutron energy have been measured for Se(1–80), Sr(6–102), Zr(2–80), Mo(1–80), Ba(15–102), Ce(5–55), and Pb(2–80); the energy range in kev of each curve is shown in parentheses. The number of peaks observed are 8, 4, 11, 9(?), 5, 12, and 10, respectively. Isotopic assignments of a few of the observed resonance peaks are Se^{80}; 3 and 7 kev; Sr^{88}; 15 and 95 kev; Zr^{90}; 43 kev; and Ce^{140}; 24 kev. No doubt many peaks, particularly those due to minor isotopes, have been missed completely. It is concluded that many of the nuclides which make up these complicated isotropic mixtures would be found to have strong, well-separated resonances if they were measured in an isotopically pure state with a neutron energy spread of the order of a few kev. (auth)

6974

THERMAL-NEUTRON FISSION CROSS SECTION OF Pu^{240}. E. K. Hulet, H. R. Bowman, M. C. Michel, and R. W. Hoff (Univ. of California, Livermore). Phys. Rev. 102, 1621 (1956) June 15.

A thermal-neutron fission cross section of 4.4 ± 0.5 barns of isotopically pure Pu^{240}, formed by the β-decay of U^{240}, has been measured in the thermal column of the Materials Testing Reactor. (auth)

6975

ANTIPROTON INTERACTION CROSS SECTIONS. Owen Chamberlain, Donald V. Keller, Emilio Segre, Herbert M. Steiner, Clyde Wiegand, and Thomas Ypsilantis (Univ. of California, Berkeley). Phys. Rev. 102, 1637-40(1956) June 15.

Using the 1.19-Bev/c antiproton beam recently discovered at the Berkeley Bevatron, the attenuation cross section in Be and Cu were measured. These cross sections are compared to attenuation measurements made with the same geometry using positive protons of the same incident energy (497 Mev). The measurements were made at cut-off angles θ_c of 12.7° for Cu, and at 18° for Be. For both Cu and Be the measured attenuation cross section for antiprotons is twice that for positive protons, with a statistical error of ±15%. In addition, for both elements, more than half the attenuation events resulted in one or more fast charged secondary particles ($\beta \geq 0.75$) —probably indicating that annihilations had taken place. The cross section results are: for Cu at $\theta_c = 12.7°$, $\sigma_p = 1.58 \pm 0.22$, $\sigma_{p^+} = 0.780 \pm 0.069$; and for Be at $\theta_c = 18°$, $\sigma_p = 0.365 \pm 0.059$, $\sigma_{p^+} = 0.178 \pm 0.013$, where the units are 10^{-24} cm^2. For Cu and Be, respectively, the average energies in the absorbers were 430 and 455 Mev. (auth)

6976

THE PROTON MAGNETIC RESONANCE SPECTRUM OF POTASSIUM AMIDE. R. Freeman and R. E. Richards (Physical Chemistry Lab., Oxford, England). Trans. Faraday Soc. 52, 802-6(1956) June.

The preparation of crystalline potassium amide free from paramagnetic impurities, is described. Proton magnetic resonance spectra have been measured at 90°K, and the second moment of the absorption line is 25.39 ± 1.49 gauss. The absorption line is a doublet and can be fitted to the curve calculated theoretically for a pair of protons. The H−H distance is found to be 1.63 ± 0.03 A. This result is discussed in terms of the H−N−H angle and the N−H distance. (auth)

6977

THE MAGNETIC MOMENT OF THE 480-KEV LEVEL OF Ta^{181}. Ernst Heer, Rudolf Rüetschi, and Paul Scherrer (Federal Technical Inst., Zurich, Switzerland). Z. Naturforsch. 10a, 834-8(1955) Nov. (In German)

6978

THE BRANCHING RATIO OF Kr^{85} FROM FISSION YIELD STUDIES. A. T. Blades and H. G. Thode (McMaster Univ., Hamilton, Ont., Canada). Z. Naturforsch. 10a, 838-40(1955) Nov. (In English)

The fission yield of the 85 mass chain has been determined both at Kr and Rb with a mass spectrometer using isotope dilution techniques. This has made possible a direct determination of the branching ratio of Kr^{85m} which turns out to be 0.28. Thus 22% of the metastable isomer (Kr^{85m}) decays to the Kr^{85} ground state. (auth)

NUCLEAR REACTORS

6979 AERE-Inf/Bib-99

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

A GENERAL INTRODUCTION TO NUCLEAR ENGINEERING: A SELECTED READING LIST. Mar. 1956. 2p.

6980 AERE-RP/M-65

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE TEMPERATURE COEFFICIENT OF HOMOGENEOUS SPHERICAL REACTORS. C. C. Horton. Nov. 3, 1955. 7p.

The temperature coefficient, (defined as $1/K_e\ \partial K_e/\partial T$ where K_e is the effective multiplication constant) is derived as a function of changes in the nuclear constants and reactor size for a spherical homogeneous reactor with an infinite reflector. It is assumed that the temperature changes in the core and reflector are the same, and that the moderating material is the same in the core and reflector. (auth)

6981 DP-132

Du Pont de Nemours (E. I.) & Co. Savannah River Lab., Augusta, Ga.

SOLUBLE NEUTRON ABSORBERS FOR EMERGENCY REACTOR SHUTDOWN. W. T. Withers. Sept. 1955. 10p. Contract AT(07-2)-1. $0.15(OTS).

The ability of ion exchange resins to remove soluble neutron absorbers from the moderator of a reactor was investigated. The soluble absorbers are materials that might be used to poison a reactor for emergency shutdown. Each of the five poisons tested was completely removed from solution by ion exchange resins and none formed an insoluble film on Al surfaces. (auth)

6982 KAPL-1499

Knolls Atomic Power Lab., Schenectady, N. Y.

REACTOR SPECTRUM MEASUREMENTS USING A NEUTRON TIME-OF-FLIGHT SPECTROMETER. R. S. Stone and R. E. Slovacek. Mar. 15, 1956. 42p. Contract W-31-109-Eng-52. $0.30(OTS).

An experimental method for the determination of the flux of a given reactor over the energy range covered by a slow chopper is presented. A method is described for simulating the flux of a desired reactor by means of a fuel-loaded matrix in a reactor thermal column. The matrix is a subcritical assembly with a source multiplication of approximately three. Because of the small size of this matrix, it is possible to equip it with the necessary heating and circulatory systems so that it may be operated under temperature conditions similar those proposed for the full-scale reactor. The functions necessary to correlate the counting rates in the various time channels of the equipment to the scalar neutron flux at the source point within the matrix are derived and discussed in detail. Experimental measurements on the shutter transmission probability and the effect of detector solid angle on system transmission are presented. (auth).

6983 KLX-1735

Vitro Corp. of America. Vitro Engineering Div., New York.

REVIEW OF FISSION PRODUCT HEAT SOURCES FOR POWER GENERATION IN THE 1-5 KW RANGE. Job 1129. Nov. 5, 1954. 30p.

The feasibility of using fission products as heat sources for power generation was reviewed. Problems to be overcome in developing fission product power units are listed. 76 references. (F.S.)

6984 NDA-18

Nuclear Development Corp. of America, White Plains, N. Y.

THE IMPROVEMENT IN SELF-REGULATING ABILITY OF WATER MODERATED REACTORS BY MEANS OF GRAPHITE AND D_2O REFLECTORS. (15H-3). Louise Gartner. Aug. 31, 1955. 16p. Contract AT(30-1)-862H. $3.30(ph OTS); $2.40(mf OTS).

Reactors with small cores with high leakage which is achieved with relatively low stainless steel-to-UO_2 and

H_2O-to-UO_2 atomic ratios were evaluated in a search for stainless steel- water reactors promising a good measure of self regulation. (F.S.)

6985 NP-6021(Pt. II)
Mine Safety Appliances Co., Callery, Penna.
LITERATURE SEARCH ON ORGANIC COOLANTS. PART II. Eugene P. Meckly. June 25, 1956. 42p. Contract NObs-65426.

A literature search for journal literature on organic compounds tested for possible application as organic compounds for cooling or moderating nuclear reactors was made. The search was limited to the following compounds: biphenyl, terphenyls and higher polyphenyls, alkyl benzenes, Dowtherms, diesel fuels, isopropyl diphenyl, and diisopropyl diphenyl. A complete subject index is included. (F.S.)

6986 WAPD-151
Westinghouse Electric Corp. Bettis Plant, Pittsburgh.
A SECOND REPORT ON MEASUREMENTS OF f, p, AND ϵ OF WATER MODERATED SLIGHTLY ENRICHED URANIUM LATTICES. A. Z. Kranz and G. G. Smith. May 1956. 74p. Contract AT-11-1-GEN-14. $0.45(OTS).

Reactor parameters have been measured for clean critical lattices of Al-clad slightly enriched U rods and H_2O moderator. The 48-inch long rods were 0.600 inch diameter at 1.15% U^{235} enrichment, and 0.387 inch diameter at 1.3% enrichment. The water to U ratios used were 3 to 1 and 2 to 1. The parameters measured were thermal utilization (f), resonance escape probability (p), and fast fission factor (ϵ). Theory, methods, and results are discussed. The difficulties described in the previous report (WAPD-134) are included, together with the measures taken to eliminate them. (auth)

6987 WAPD-CE-43
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
DESIGN BASIS FOR REACTOR VESSELS. B. F. Langer. Oct. 18, 1955. 14p.

The design basis to be used for reactor pressure vessels for Naval service is specified. Type of loading and operating conditions are given. Methods of formulating stress and minimum stress values to be met are listed. (D.E.B.)

6988 WAPD-RM-187
Westinghouse Electric Corp. Atomic Power Div., Pittsburgh.
CVR PRESSURIZER SIMULATOR STUDY. W. M. Gajewski and J. N. Grace. July 1953. Decl. Nov. 22, 1955. 34p. Contract AT-11-1-GEN-14. $0.25(OTS).

The response of the primary coolant pressurizing system to rapid changes in steam plant load is studied by means of analog computer techniques. Results are plotted for a range of values of the pressurizer design parameters. (auth)

6989 AERE-Lib/Trans-692
FISSION OF URANIUM NUCLEI BY FAST PROTONS. V. I. Ostroumov. Translated by S. Botcharsky from Doklady Akad. Nauk S.S.S.R. 103, 409-11(1955). 5p.

The fission of U nuclei by fast protons was studied in special fine-grain nuclear emulsions prepared so that only heavy particle fragments would be registered. The plates were impregnated with an aqueous solution of U salt and exposed in a proton beam of energy 450 Mev. Angular fissions with inclination of more than 50° were studied. (F.S.)

6990
ESTIMATION OF HEAT SOURCES IN NUCLEAR REACTORS. Lloyd G. Alexander (Oak Ridge National Lab., Tenn.). A.I.Ch.E. Journal 2, 177-83(1956) June.

Knowledge of local heating rates is needed for estimation of operating temperatures, thermal stresses, and cooling requirements in nuclear reactor components. Heat is liberated by the dissipation of the energy of fission fragments, beta particles, fast neutrons, and gamma photons. Heating rates are formulated in terms of either neutron or gamma flux densities, the corresponding collision probabilities, and appropriate energy transfer coefficients, the forms of which are given. Special methods of estimating the flux densities are discussed. The data on the magnitudes of the various energy sources are reviewed. (auth)

6991
NEUTRON LIFETIMES AND VOID COEFFICIENTS FOR RESEARCH REACTORS. Thomas H. Pigford, Marius Troost, James R. Powell, and Manson Benedict (Massachusetts Inst. of Tech., Cambridge). A.I.Ch.E. Journal 2, 219-25(1956) June.

Prompt neutron lifetimes and void coefficients were calculated for research reactors using M.T.R.-type fuel elements, moderators of light and heavy water, and reflectors of light water, heavy water, graphite, and beryllium. Heavy-water-reflected and -moderated research reactors may have neutron lifetimes of the order of 0.001 sec. as compared with about 0.00006 sec. for a light-water-reflected and -moderated research reactor. Lifetime of the light-water core can be improved considerably by use of better reflectors, but at a substantial reduction and even reversal in sign of the void coefficient. (auth)

6992
ESTIMATING COST FOR RADIOCHEMICAL PLANTS. W. G. Stockdale, Oak Ridge National Lab., Tenn.). Chem. Eng. 63, No. 4, 185-7(1956) Apr.

Capital and operating costs for direct-maintenance solvent-extraction plants processing enriched spent reactor fuels are estimated. Design and operational features peculiar to radiochemical plants are discussed. (C.W.H.)

6993
TEMPERATURE MEASUREMENTS IN AN AL-CLAD U SLUG. G. Franco and A. Pedretti (Laboratori CISE, Milan). Energia nucleare (Milan) 3, 39-45(1956) Feb. 15. (In Italian).

Maximum temperatures were measured inside a natural U slug, canned with commercial grade Al tube, heated with electric current sufficient to generate in it thermal powers to 500 W per cm length, and water cooled with forced convection. Information was derived about thermal behaviour of nuclear reactor fuel elements. (auth)

6994
PHYSICS OF THE WATER-MODERATED REACTOR. I. V. Kurchatov (Academy of Sciences of the U.S.S.R.). Nuclear Eng. 1, 101-3(1956) June.

The physics of water-moderated reactors is discussed with particular emphasis on the role played by epithermal neutrons. (F.S.)

6995
AMERICAN REACTOR PROGRAMME. Nuclear Eng. 1, 116-18(1956) June.

Summarized details are given of the power reactor experiments completed and under construction in the U.S.A.E.C. programme. So far as nuclear power stations for electricity supply are concerned, seven are planned, using five different types of reactor: pressurized water, boiling water, sodium graphite, fast breeder and homogeneous. (auth)

6996
THE WORLD'S REACTORS. NO. 3. NRX. Nuclear Eng. 1, 106a(1956) June.

Data sheets and pictures of the NRX reactor are presented. (F.S.)

6997
A LETTER ON EBR-I FUEL MELTDOWN. W. H. Zinn

(Argonne National Lab., Lemont, Ill.). Nucleonics 14, No. 6, 35, 103-4, & 119(1956) June.

The controlled experiment, to obtain the temperature coefficient of the fuel in the EBR-1, which resulted in the fuel-meltdown, is discussed. The cause of the meltdown is explained and the information yielded by this unplanned part of the experiment is evaluated. (F.S.)

6998

TESTING NUCLEAR-PLANT LEAKTIGHTNESS. J. P. Verkamp and S. L. Williams (Knolls Atomic Power Lab., Schenectady, N. Y.). Nucleonics 14, No. 6, 54-7(1956) June.

Although leakage control has been an important consideration in remote nuclear power plants, greater emphasis on leak tightness will be necessary for plants located in populated areas. Methods of leak control are reviewed and the leak testing of the KAPL-operated Na plant is evaluated. (F.S.)

6999

TESTING OPERATING SAFETY OF A WATER-BOILER RESEARCH REACTOR. J. W. Flora and J. W. Shortall (California Research and Development Co., Livermore, Calif.). Nucleonics 14, No. 6, 58-62(1956) June.

Operational safety performance of the Livermore Research Laboratory water-boiler-type research reactor was investigated. Factors tested were temperature coefficient of reactivity, transient behavior, buildup and decay of volatile activity, danger coefficients, effect of loss of coolant, poisoning effect of an absorber placed in the core, control rod calibration, safety devices response time, and void effects in the reflector. (F.S.)

7000

REACTORS IN AEC'S SECOND-ROUND POWER DEMONSTRATION REACTOR PROGRAM. Nucleonics 14, No. 6, 96 (1956) June.

The characteristics of the seven small reactor plants proposed in the second round of AEC's power demonstration reactor program and the costs per kw are given and compared with the first 10 in the AEC program. (F.S.)

NUCLEAR TRANSFORMATION

7001 AD-73477

Maryland. Univ. College Park.

THE β-DECAY OF C^{14} AND NUCLEAR FORCES. Physics Department Technical Report No. 19 [for] Period April 1 to September 30, 1955. W. M. Visscher and R. A. Ferrell. Sept. 1955. 40p. Contract Nonr 594(00).

The anomalously long lifetime of C^{14} is interpreted as being due to an accidental cancellation in the β-decay matrix element. Using harmonic-oscillator wave-functions and gaussian potentials, sets of values for the nuclear force parameters are obtained, giving zero matrix element, which include a wide range of tensor force strengths. A nuclear potential of arbitrary exchange character is assumed, including central, tensor, and spin-orbit parts, and its parameters are fixed by consideration of certain nuclear data, including the β-decay lifetime. The latter, it turns out, is very sensitive to the strength of the tensor force, and may be expected to provide an accurate determination of it. The properties of the $(1s)^4(1p)^{10}$ and $(1s)^4(1p)^2$ nuclei which may easily be calculated by using the nuclear force thus obtained are given, including the energy-level spectrum, and quadrupole and magnetic moments. Appendices include a proof of the impossibility of cancellation without tensor forces or configuration mixing, and discussions of hole conjugation (the partial equivalence of the $(1s)^4(1p)^{10}$ and $(1s)^4(1p)^2$ problems) and configuration mixing. (auth)

7002 USNRDL-TR-81

Naval Radiological Defense Lab., San Francisco.

A MEASUREMENT OF THE CROSS SECTION FOR THE $C^{12}(n,p)B^{12}$ REACTION. W. E. Kreger, H. Bolotin, and E. A. Edelsack. Mar. 2, 1956. 64p. Project NS 081-001.

The cross section for the $C^{12}(n,p)B^{12}$ reaction has been measured at a neutron energy of 17.3 ± 0.3 Mev by determining the yield of the delayed 4.45-Mev gamma rays which occur in 1.3% of the B^{12} decays. Adaptation of the 2-Mev Van de Graaff Accelerator for producing a pulsed neutron beam for this determination is described. The cross section value is 11.1 ± 7.7 millibarns. This value is in fair agreement with a predicted value of 20 millibarns based on comparison with a similar reaction. (auth)

7003 AERE-Lib/Trans-612

FISSION OF URANIUM NUCLEI INDUCED BY SLOW [π] MESONS AND HIGH-ENERGY PARTICLES. G. E. Belovitskii, T. A. Romanova, L. V. Sukhov, and I. M. Frank. Translated by J. B. Sykes from Zhur. Eksptl'. i Teoret. Fiz. 28, 729-32(1955). 5p.

An investigation was made of uranium fission induced by π^- meson, by 14-, 180-, and 460-Mev neutrons, and by γ rays with energies up to 250 Mev. A comparison of experiments for neutrons of the three energies shows that the number of fissions, accompanied by emissions of long-range particles, increases rapidly with the energy of the primary neutrons. The results of γ-ray irradiations indicated that fissions with the emission of fast charged particles are caused by high-energy photons, thus refuting the hypothesis that the effective cross section for uranium nuclei fission at γ-ray energies above 100 Mev is almost zero. (R.V.J.)

7004 AERE-Lib/Trans-718

POSSIBILITY OF APPLYING CORRELATION FUNCTIONS TO THE STUDY OF NUCLEAR TRANSFORMATIONS. V. I. Goldanskii and M. I. Podgoretskii. Translated by R. C. Murray from Doklady Akad. Nauk S.S.S.R. 100, 236-40(1955). 6p.

In a study of correlation factors for the study of nuclear transformations, the coincidence method was found to be only a special case of the statistical method. The correlation method can solve not only all problems solved by the coincidence procedure, but also problems in the study of related processes, separated by large intervals of time. (F.S.)

7005

SEARCH FOR Be^{10} AS A PRODUCT OF TERNARY FISSION. K. F. Flynn, L. E. Glendenin, and E. P. Steinberg (Argonne National Lab., Lemont, Ill.). Phys. Rev. 101, 1492(1956) Mar. 1.

The possibility of the formation of Be^{10} as a product of ternary fission of U^{235} has been investigated radiochemically. An upper limit of 4×10^{-4}% fission yield was determined. This low value is inconsistent with the recently proposed assignment of the 0.15-sec delayed-neutron period to Li^9. (auth)

7006

NUCLEAR REACTIONS OF COBALT WITH PROTONS FROM 0- TO 100-MEV ENERGY. Rodman A. Sharp, Richard M. Diamond, and Geoffrey Wilkinson (Harvard Univ., Cambridge, Mass.). Phys. Rev. 101, 1493-1504(1956) Mar. 1.

Absolute excitation functions for 0- to 100-Mev protons on Co have been measured for 18 radioactive products from V through Ni. Linear-accelerator bombardments in the 0- to 30-Mev region plus a scattered-beam cyclotron technique gave good energy resolution. The results are in qualitative agreement with the Bohr compound nucleus picture at low energies and a mixture of the Bohr and Serber mecha-

nisms at higher energies. Evidence for high yields of alpha-particle emission was found. The influence of shell structure on yields was pronounced, with magic-number nuclei having especially low yields. (auth)

7007

NEUTRON-INDUCED CHARGED PARTICLE REACTIONS IN POTASSIUM-39. Mary Jean Scott and Ralph E. Segel (Johns Hopkins Univ., Baltimore). Phys. Rev. 102, 1557-9(1956) June 15.

Thin thallium-activated potassium iodide crystals were exposed to monoenergetic neutrons ranging in energy from 2.0 to 5.5 Mev. Pulse-height spectra were taken of the scintillations in the crystal. Five charged particle groups were observed, three (n,p) reactions leading to states in A^{39}, and two (n,α) reactions leading to states in Cl^{36}. A new level was discovered at 2.46 ± 0.1 Mev in A^{39}, and the level at about 1.25 Mev in A^{39} confirmed. Yield curves were measured for three of the groups. (auth)

7008

ON HEAVY PARTICLE SPECTROSCOPY TECHNIQUE, ITS APPLICATION TO SCATTERING MASS ANALYSIS AND THE $Al^{27}(d,\alpha)Mg^{25}$ AND $Al^{27}(d,p)Al^{28}$ REACTIONS. Harald A. Enge. Univ. Bergen Arbok, Naturvitenskap. Rekke, No. 1, 1954. 101p. (In English)

The excitation energies, spins, and parities of the energy levels in light nuclei were studied to be used in the development of theories of nuclear structure and nuclear forces. The $Al^{27}(d,\alpha)Mg^{25}$ and $Al^{27}(d,p)Al^{28}$ reactions energy levels were investigated in a 180° focusing magnetic spectrometer and a 2-Mev Van de Graaff generator. (F.S.)

7009

ANGULAR DISTRIBUTION OF NEUTRONS IN REACTION T (p,n) He^3. G. V. Gorlov, B. M. Gokhberg, V. M. Morozov, and V. A. Shigin. Zhur. Tekh. Fiz. 26, 985-9(1956) May. (In Russian)

Measurements of the angular distribution of neutrons in the reaction T (p,n) He^3 were made for 1200-, 1400-, and 1600-kev protons and results obtained for 1400- and 1600-kev protons coincided with those obtained previously by G A. Jarvis et al. (Phys. Rev. 79, 929 (1950)). The angular distributions of 1200-kev protons for angles larger than 100° were calculated and corrected. (R.V.J.)

7010

EFFECTIVE CAPTURE CROSS SECTION OF Pa-233 FOR THERMAL REACTOR NEUTRONS. J. Halperin, R. W. Stoughton, C. V. Ellison, and D. E. Ferguson (Oak Ridge National Lab., Tenn.). Nuclear Sci. and Eng. 1, 1-3(1956) Mar.

Thorium metal was irradiated in the thermal neutron flux of the Low Intensity Test Reactor and of a graphite reactor. From mass spectrographic analysis of the U^{234} content and assumption of an effective capture cross section (including epithermal as well as thermal neutron capture) of 8.0 barns for Th^{232}, the effective neutron capture cross section of Pa^{233} for thermal reactor neutrons was determined to be 140 ± 20 barns. (auth)

7011

^{8}Li EMISSION FROM PROTON INDUCED DISINTEGRATIONS AT 950 MEV. B. A. Munir (Univ. of Birmingham, England). Phil. Mag. (8) 1, 355-62(1956) Apr.

G5 plates exposed to 950 Mev protons were scanned and fifty Li^8 'Hammer stars' discovered. They were divided into stars representing light and heavy nuclei disintegrations. In the case of light element stars the energy and angular distributions of the Li^8 fragment indicate that it is the residual nucleus after a light element breakup. For heavy nuclei stars the mechanisms of direct knock-on and evaporation can be excluded. The simplest hypothesis is that the fragments are ejected as part of the cascade process. (auth)

Refer also to abstract 6969.

PARTICLE ACCELERATORS

7012 CERN-56-1

European Organization for Nuclear Research, Geneva.
THE DESIGN OF THE CERN SYNCHRO-CYCLOTRON CONTROL SYSTEM. Pierre Debraine, Marcel Lažanski, and Guy Boyadjian. Jan. 15, 1956. 46p.

The principles underlying the CERN synchrocyclotron control system are discussed and an outline of its essential features is given. The description of some specific control circuits (ion sources, targets and associated equipment, radiation safety system) is not final since the design of these elements of the synchrocyclotron are not yet complete. (auth)

7013 CERN-56-8

ON THE INFLUENCE OF IRREGULARITIES OF MAGNETIC FIELD ON BETATRON OSCILLATIONS IN AN ALTERNATING GRADIENT SYNCHROTRON. (Uber den Einfluss von Fehlern des Magnetischen Feldes auf die Betatronschwingungen im Synchrotron mit Starker Stabilisierung). G. Lüders. Translated from Nuovo cimento (10), 2, Suppl., 1075-1146(1955). 81p.

Mathematical methods and formulas for the treatment of deviations in the magnetic guiding field and in the field index were derived and evaluated for use in designing an alternating gradient synchrotron. (F.S.)

7014 MURA-ESA-4

Purdue Univ., Lafayette, Ind. and Midwest[ern] Universities Research Assn., Urbana, Ill.
THE MAGNETIC FIELD AND THE EQUATIONS OF MOTION IN SPHERICAL COORDINATES FOR THE MARK V, FFAG ACCELERATOR. Edward S. Akeley. May 1956. 23p.

Spherical coordinates are especially suited for the expression of the magnetic field of the Mark V FFAG accelerator. The magnetic induction is assumed given in the median plane in the form of a series of circular harmonics. Expansions are then given for the magnetic induction, and its vector and scaler potentials on both sides of this plane. An exact solution is given by making use of associated Legendre functions. Certain approximations and series expansions are introduced. A particularly simple approximation is worked out in detail. If used for the equations of motion it is always required that any approximation satisfy the Liouville theorem exactly. The Lagrangian and Hamiltonian equations are derived. (auth)

7015 MURA-KRS/AMS-1

Wisconsin. Univ., Madison; Ohio State Univ., Columbus and Midwestern Universities Research Assn., Urbana, Ill.
METHODS OF RADIO FREQUENCY ACCELERATION IN FIXED FIELD ACCELERATORS WITH APPLICATIONS TO HIGH CURRENT AND INTERSECTING BEAM ACCELERATORS. K. R. Symon and A. M. Sessler. Apr. 16, 1956. 55p.

A survey of ideas for radio-frequency acceleration was made. High intensity beams, essential in the operation of a double accelerator with interacting beams, were studied. The theory of the use of fixed-field accelerators to use radiofrequency acceleration was mathematically analyzed. (F.S.)

7016 MURA-LJL-9

Midwestern Universities Research Assn., Urbana, Ill.
ANALYSIS AND COMPUTATIONS OF MAGNETIC FIELDS ARISING FROM TWO-DIMENSIONAL POLE CONFIGURATIONS OF INTEREST IN SPIRAL-SECTOR ACCELERATORS. L. Jackson Laslett. [1956?]. 47p. $7.80(ph OTS); $3.30(mf OTS).

Computations have been made, for the greater part by aid of the ILLIAC digital computer, of the median-plane fields which result magnetostatically from various two-dimensional pole configurations resembling those which would be employed in a spirally-ridged FFAG accelerator. (auth)

7017 MURA-LWJ-11

Michigan. Univ., Ann Arbor and Midwestern Universities Research Assn., Urbana, Ill.
CONCENTRIC AND ECCENTRIC COLLIDING BEAMS GEOMETRIES. Lawrence W. Jones. May 4, 1956. 7p.

The virtues and drawbacks of the alternating colliding beams methods geometry for the F. F. A. G. Synchrotron are discussed. (F.S.)

7018 NP-6023

Indiana Univ., Bloomington. Chemical Lab.
PHYSICOCHEMICAL REACTIONS OF IONIC BEAMS. [Period covered] September 1953–June 1956. Walter J. Moore, Cormac D. O'Briain, and Amelie Lindner. July 1, 1956. 60p. Contract DA-33-008-ORD-891.

An apparatus has been designed and constructed to investigate the physicochemical interactions of ionic beams with crystalline surfaces. Ions from a radiofrequency source are focused, magnetically analyzed, and caused to impinge on the target surface. The energies of the ions can be varied between 500 and 10,000 ev, and the beam intensity is 1.0 to 50 μamp. Incorporation of radioactive tracers in the solid targets permits the measurement of as little as 0.02 μg of sputtered material, and the distribution of radioactivity over the collectors provides a direct measure of the angular variation of sputtering. The secondary-electron and reflected-ion currents are measured in the course of each run, so that absolute sputtering coefficients can be calculated. Early results with H^+, D^+, and H_2^+ ions on Ag surfaces are reported. (auth)

7019 NYO-4699

New York Operations Office. Health and Safety Lab., AEC.
STRAY RADIATION MEASUREMENTS AT PARTICLE ACCELERATOR SITES. Leonard R. Solon, James E. McLaughlin, Jr., and Hanson Blatz. June 1, 1956. 67p. $0.40(OTS).

This progress report reviews stray radiation measurements made at representative accelerator sites by members of the Health and Safety Laboratory. Information is presented on radiation levels encountered, personnel monitoring records, economics of radiation protection, and biological effects of ionizing radiation with relation to accelerator operation. (auth)

7020

ON RADIATIONS OF BETATRON OSCILLATIONS OF ELECTRONS IN STRONG-FOCUSING SYNCHROTRONS. A. N. Matveev (Lomonosov Moscow State Univ.). Doklady Akad. Nauk S.S.S.R. 107, 677-4(1956) Apr. 11. (In Russian)

Results of preliminary studies on the radiation of betatron radial oscillations of electrons in an alternating-gradient synchrotron are described. It is shown that betatron axial oscillations can be studied by the analogous method, but the fact that the square of amplitudes is $(E/mc^2)^2$ times smaller than the radial oscillations prevents one from obtaining accurate results at all energies. (R.V.J.)

7021

ELECTROSTATIC DEFLECTION OF A CYCLOTRON ION BEAM. Jun Kokame and Sukeaki Yamashita (Univ. of Kyoto, Japan). J. Phys. Soc. Japan 11, 332-3(1956) Mar.

Equations are given for ion trajectories in a cyclotron. (B.J.H.)

7022

THE PRINCIPLES AND APPARATUS OF THE INJECTION SYSTEM OF THE BIRMINGHAM PROTON SYNCHROTRON. C. A. Ramm (Univ. of Birmingham, England). J. Sci. Instr. 33, 52-8(1956) Feb.

An outline is given of the principles used in the injection system of the Birmingham proton synchrotron which make the injection process relatively automatic and free from the necessity of a primary proton beam with an energy of great stability. A simple analysis is made of particle collection in the absence of the radio-frequency acceleration. The basic components and methods of monitoring the injection system are described. (auth)

7023

DESIGN OF THE POLE FACES FOR CIRCULAR PARTICLE ACCELERATORS WITH THE ELECTROLYTIC TANK. F. Amman (Istituto Nazionale di Fisica Nucleare, Sezione Acceleratore, Rome) and L. Dadda (Istituto di Elettrotecnica Generale del Politecnico, Milan). Nuovo cimento (10) 3, 184-7(1956) Jan. (In English)

A method is presented here for the measurement of a quantity approximately proportional to the second derivative of the electric potential in the electrolytic tank. This method is very useful for the measurement of the field index n in the gap of a circular particle accelerator. (auth)

7024

THE NON LINEAR THEORY OF BETATRON OSCILLATIONS IN THE STRONG-FOCUSING SYNCHROTRON. I. Y. Orlov (Academy of Sciences of the U.S.S.R., Moscow). Nuovo cimento (10) 3, 252-9(1956) Feb. (In English).

A new method of the investigation of betatron resonances has been developed. The resonances due to errors in the field gradient have been examined. (auth)

7025

ELECTRODYNAMICS OF MOVING MEDIA AND THE THEORY OF THE ČERENKOV EFFECT. B. D. Nag and Abul Maksud Sayied (Institute of Nuclear Physics, Calcutta). Proc. Roy Soc. (London) A235, 544-51(1956) June 12.

The generalized Frank & Tamm's formula for the total energy radiated as Cherenkov radiation by a swiftly moving charged particle in a medium of dielectric constant ϵ and permeability μ has been derived employing the invariance of the phenomenological electrodynamic equations of Maxwell. The scheme is self-consistent, and the idea of the indetectability of the ether wind is contained in it. It is found that the Cherenkov radiation is μ times larger than that predicted by the Frank & Tamm's formula for $\mu = 1$. Experiments are suggested to detect strong Cherenkov radiation in highly permeable mediums. (auth)

7026

FOCUSING SYSTEM OF AN ION ACCELERATION TUBE. Yu. Yu. Lapitskiĭ, I. I. Levintov, I. N. Slivkov, and V. N. Shamshev (Inst. of Chem. Physics). Zhur. Tekh. Fiz. 26, 733-9(1956) Apr. (In Russian)

Calculations are given for an ion-optical system producing and focusing a 1-Mev ion beam for an acceleration tube. A sufficiently thin, easily regulated beam of 800 μamp in the normal state and increased by an impulse up to 2 ma (length of impulse 1 msec) was experimentally developed. Further intensification of the current was limited by the source and the thermal conditions of the target. The system permits wide variations in the con-

version angle of the beam injected into the entrance of the acceleration part of the tube, and, consequently, with few alterations, can be used for other tubes. (R.V.J.)

7027

ON ELIMINATION OF THE CRITICAL ENERGY IN THE SYNCHROPHASATRON WITH STRONG FOCUSING. A. A. Kolomenskiĭ. (Lebedev Inst. of Physics). Zhur. Tekh. Phys. 26, 740-8(1956) Apr. (In Russian)

Critical energy interference with the autophasing properties of accelerators and its effects on the production of protons of high energies are discussed. Elimination of the critical energy factor in strong-focusing accelerators by introducing areas with inverse curvatures has been offered previously. This method was applied to one of the variations of a ring synchrocyclotron — a strong-focusing accelerator with a constant magnetic field. Later it was shown that the same method holds for a strong-focusing bevatron with a varying magnetic field. Other works suggested that the method can be considerably improved by "resonance" disposition of inverse curvature areas in the installation. A matrix method is applied to obtain the equation for the critical energy factor in relation to various parameters of the installation and the resulting conditions are evaluated with the purpose of eliminating the critical energy. (R.V.J.)

Refer also to abstracts 6457 and 6837.

RADIATION ABSORPTION AND SCATTERING

7028 AERE-Lib/Trans-578

POLARISATION OF VERY FAST NEUTRONS ON SCATTERING AT HEAVY NUCLEI. I. I. Levintov. Translated by J. B. Sykes from Doklady Akad. Nauk S.S.S.R. 98, 373-6 (1954). 6p.

An abstract of this paper appears in Nuclear Science Abstracts as NSA 9-2042.

7029

CROSS SECTION FOR FAST PARTICLE ABSORPTION BY SEMI TRANSPARENT NUCLEI. S. I. Drozdov Doklady Akad. Nauk S.S.S.R. 106, 409-12(1956) Jan. 21. (In Russian).

Equations are given for calculations of neutron and charged particle scattering and absorption by semitransparent nuclei. (R.V.J.)

7030

ČERENKOV RADIATION FROM EXTENDED ELECTRON BEAMS NEAR A MEDIUM OF COMPLEX INDEX OF REFRACTION. Herbert Lashinsky (Columbia Univ., New York). J. Appl. Phys. 27, 631-5(1956) June.

An earlier theoretical treatment of the Cherenkov radiation excited by the passage of a bunched electron beam moving parallel to a dielectric medium at a small distance is extended to the case of a medium with a complex index of refraction. It is found that under suitable conditions, the use of a ferrite material as a medium can in principle enhance the radiated power. This effect is analyzed in terms of the work done by the beam on the field and the coupling between the beam and the medium. (auth)

7031

LOW-ANGLE X-RAY SCATTERING BY SURFACE DEFECTS. W. H. Robinson and R. Smoluchowski (Carnegie Inst. of Tech., Pittsburgh). J. Appl. Phys. 27, 657-8(1956) June.

Samples of annealed Zn were electropolished for varying periods and the intensity of scattered x rays measured. Plots of the scattering indicates a direct relationship with surface defects. (D.E.B.)

7032

SOME CONSIDERATIONS ON THE PHASE-SHIFT ANALYSIS IN THE (p^+-p^+) SCATTERING. G. Puppi and A. Stanghellini (Istituto di Fisica dell'Universita, Bologna). Nuovo cimento (10) 3, 491-5(1956) Feb. (In English).

7033

A HIGH ACCURACY APPROXIMATION FOR SOLVING MULTIPLE SCATTERING PROBLEMS IN INFINITE HOMOGENEOUS MEDIA. C. C. Groshean (Interuniversitair Instituut voor Kernwetenschappen Centrum van de Rijksuniversiteit Gent, Belgium). Nuovo cimento (10) 3, 1262-75(1956) June.

An approximate formula describing the steady-state density of isotropically scattered particles emitted by a point source in an infinite homogeneous medium is presented and compared with the exact distribution. In an infinite homogeneous medium, it can be applied in the calculation of the particle density in the presence of a given source distribution. The method by which the formula has been deduced, permits a direct generalization to the case of non-isotropic scattering. (auth)

7034

THE COUPLING CONSTANT OF p-WAVE PION NUCLEON SCATTERING. M. Cini (Istituto di Fisica dell'Universita, Catania); S. Fubini (Istituto di Fisica dell'Universita, Torin); and A. Stanghellini (Istituto di Fisica dell'Universita, Bologna). Nuovo cimento (10) 3, 1380-6(1956) June.

Introducing the experimental data for the phase-shift δ_{33} of the pion-nucleon scattering, in the Low equation, the renormalized p-wave coupling constant f^2 was calculated and the following value was obtained: $f^2 = 0.107 \pm 0.006$. The reliability of this result is discussed. (auth)

7035

SPURIOUS SCATTERING IN NUCLEAR EMULSIONS. F. A. Brisbout, C. Dahanayake, A. Engler, P. H. Fowler, and P. B. Jones (Univ. of Bristol, England). Nuovo cimento (10) 3, 1400-10(1956) June.

Spurious scattering has been investigated in three stacks of stripped emulsions; one of these has been exposed to the 4.5 Bev π-meson beam at Berkeley, the other two to cosmic radiation. Multiple scattering measurements performed on flat tracks of high energy particles show that the spurious scattering in two of these stacks is appreciably smaller than that obtained by other investigators and that reliable measurements up to 5 Bev (for singly charged particles) can be made using a basic cell size of one mm. Clearly spurious scattering is a function of the quality of the stack. A procedure for eliminating spurious scattering is suggested which in particular cases permits measurements to be extended to higher energy regions. (auth)

7036

ON THE PION ANNIHILATION OF NUCLEON-ANTIPROTON PAIRS. D. Amati and B. Vitale (Istituto di Fisica dell'Universita, Rome). Nuovo cimento (10) 3, 1411-24(1956) June.

The pion annihilation of antiproton-nucleon pairs in bound S-states (singlet and triplet) is analyzed taking into account conservation law and selection rules previously founded. With a statistical model for the valuation of transition matrix elements the ratio of three pion to two pion annihilation is calculated and, for the 3π annihilation, the angular distributions and energy spectrum of the final mesons. Finally some considerations are done about the annihilation of the pair from isotopic spin eigenstates. (auth)

7037

GAMMA RAYS FROM INELASTIC NEUTRON SCATTERING IN SODIUM AND IODINE. Elizabeth A. Wolfe (Clarendon Lab., Oxford, England). Phil. Mag. (8) 1, 102-4(1956) Jan.

7038
ELASTIC SCATTERING OF 40-MEV ALPHA PARTICLES FROM LIGHT ELEMENTS. G. Igo, H. E. Wegner, and R. M. Eisberg (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 101, 1508-14(1956) Mar. 1.

The angular distribution for the elastic scattering of 40-Mev alpha particles from C, Al, Ti, Cu, Nb, Mo, and Ag has been measured. The angular distributions are characterized by strong diffraction patterns in contrast to the monotonically decreasing angular distributions of alpha particles scattered from Ta, Au, Pb, and Th. An analysis of the relative positions of the diffraction maxima yields a value for the interaction radius of $[(1.27 \pm 0.07)A^{1/3} + (1.60 \pm 0.23)] \times 10^{-13}$ cm. A comparison is made of the angular distributions measured at the energies of 19, 22, 40, and 48 Mev. (auth)

7039
CHARGE ANALYSIS AND DIFFERENTIAL CROSS-SECTION MEASUREMENTS FOR LARGE-ANGLE ARGON ION–ARGON ATOM COLLISIONS WITH ENERGIES BETWEEN 25 AND 138 KEV. R. J. Carbone, E. N. Fuls, and E. Everhart (Univ. of Connecticut, Storrs). Phys. Rev. 102, 1524-30(1956) June 15.

The charge states and differential cross sections of the scattered particles at each angle have been measured for individual collisions between argon ions and argon atoms at large angles. The angular interval ranged from 4 to 20 degrees with a resolution of one degree. Data are presented for several energies between 25 and 138 kev inclusive. The ion beam traversed a collision chamber which contained the target gas argon. The pressure was maintained low enough to insure that the collision products resulted from two-body interactions, i.e., from single collisions. The scattered particles at each angle passed through a pair of collimating holes and then through an electrostatic analyzer. Percentages in various charge states, ranging from neutral to seven times ionized, were measured. The extent of ionization is found to be a function of the distance of closest approach during the collision in question and not primarily a function of the energy. The data are also used to determine the absolute differential cross section for scattering of particles. These cross sections are lower than those predicted for simple Coulomb scattering because of the screening effect of the atomic electrons. Agreement is good between the measured cross sections and those calculated from an exponentially screened Coulomb potential. (auth)

7040
MULTIPLE ELASTIC SCATTERING IN ELECTRON DIFFRACTION BY MOLECULES. Jean A. Hoerni (California Inst. of Tech., Pasadena). Phys. Rev. 102, 1530-3(1956) June 15.

Electron diffraction patterns from gas molecules containing heavy atoms can be satisfactorily interpreted in terms of a pseudokinematical theory, in which rigorous atomic scattering amplitudes are used, but the Born approximation is retained for expressing the (molecular) interference between the various atomic contributions. It is shown that the correction brought by the second approximation of the pseudokinematical theory, involving multiple scattering on different atoms, is a smooth function of scattering angle and is therefore unimportant in the study of the oscillating interference term. (auth)

7041
MULTIPLE ELASTIC SCATTERING IN ELECTRON DIFFRACTION BY CRYSTALS. Jean A. Hoerni (California Inst of Tech., Pasadena). Phys. Rev. 102, 1534-42(1956) June 15.

In the case of electron diffraction by crystals containing heavy atoms, it is possible to improve the usual kinematical theory by formulating a pseudokinematical theory, which is expressed in terms of rigorous atomic scattering amplitudes rather than their Born-approximation values. A corresponding improvement can be made in the treatment of the problem by the dynamical theory, and consists in taking into account the coupling of a given diffracted beam with not only the incident beam (as is usually done in first approximation) but also with other diffracted beams. The pseudokinematical and dynamical theories are compared for very thin crystals and the conditions under which both give identical results are discussed. In particular, both predict a failure of Friedel's law in the case of acentric crystals. (auth)

7042
ELASTIC SCATTERING OF 5.25-MEV PROTONS FROM Co, Ni, Cu, AND Zn. D. A. Bromley and N. S. Wall (Univ. of Rochester, New York). Phys. Rev. 102, 1560-7(1956) June 15.

The angular distributions of 5.25-Mev protons scattered by natural targets of elements with Z = 27 through Z = 30 have been measured. All angular distributions show a minimum in the differential cross section relative to Coulomb scattering at about 85°. The Ni and Zn relative cross sections then rise linearly whereas there is no systematic behavior for the Co and Cu. The Cu relative cross section has maxima at about 45° and 130° and the Co has a region of approximately constant relative cross section at large angles. The angular distribution for Ni has been fitted by Saxon using a complex potential well; however, when one uses the same parameter for Co, Cu, and Zn, essentially no agreement is found. (auth)

7043
CALCULATION OF ELECTRON-DEUTERON SCATTERING CROSS SECTIONS. V. Z. Jankus (Stanford Univ., Calif.). Phys. Rev. 102, 1586-91(1956) June 15.

Elastic and inelastic cross sections for electron-deuteron scattering with large momentum transfer have been investigated. The calculation has been performed in the first Born approximation. The neutron-proton interaction has been described by a phenomenological potential, and the nucleons have been represented by point charges and point magnetic moments. Finite size of nucleons causes major correction to these results. (auth)

7044
REMARKS ON SCATTERING THEORY. Roger G. Newton (Indiana Univ., Bloomington). Phys. Rev. 101, 1588-96 (1956) Mar. 1.

Some consequences of the construction of potentials from phase shifts are derived. The question of selecting a unique potential by asymptotic requirements, and the connection with analyticity of the S-matrix is discussed. An expression for the variational derivative of the potential with respect to the phase shift is derived. A simple exact relation between the value of the potential at the origin and the first moment of the phase shift emerges as a result. The variational derivative is made the basis of a "phase-shift perturbation method." One "unperturbed" S-matrix suggests itself naturally, and is here called the "intrinsic" S-matrix of the bound state. The "intrinsic" potential is discussed. Variational derivatives of one phase shift with respect to another, as well as an extension of the phase-shift perturbation method near the intrinsic S-matrix to the presence of a tensor force, are given. (auth)

7045
DIFFERENTIAL CROSS-SECTION MEASUREMENTS OF THIN-TARGET BREMSSTRAHLUNG PRODUCED BY 2.7- TO 9.7-MEV ELECTRONS. N. Starfelt and H. W. Koch (National Bureau of Standards, Washington, D. C.). Phys. Rev. 102, 1598-1612(1956) June 15.

The electron beam removed from a 50-Mev betatron

and a total absorption scintillation spectrometer containing a sodium iodide crystal 5 in. in diameter and 9 in. long were used for the measurement of bremsstrahlung cross sections that are differential in photon energy and angle. Thin targets of beryllium, aluminum, and gold were bombarded by electrons with kinetic energies of 2.72, 4.54, and 9.66 Mev. The bremsstrahlung spectra from thick tungsten targets were also studied. The results were compared with the differential cross-section predictions of Sauter, Schiff, and Gluckstern and Hull. The spectral shapes obtained with the beryllium and aluminum targets agreed with those expected from theory for the electron energies of 2.72 and 4.54 Mev. The 9.66-Mev experiment gave 20% more low-energy than intermediate-energy photons when compared with theory. For gold the experimental cross sections for the high photon energies are larger than theory with the differences increasing with decreasing electron primary energy. Evidence for electron-electron bremsstrahlung is obtained from the absolute magnitude of the differential cross sections, which are $(Z+1)/Z$ times larger than theory within the experimental errors. The thick-target tungsten spectra produced by 9.66-Mev electrons decreased more rapidly with increasing photon energy than did the thin-target cross sections derived by Schiff. (auth)

7046

INTERACTIONS OF ANTIPROTONS IN LEAD GLASS. John M. Brabant, Bruce Cork, Nahmin Norwitz, Burton J. Moyer, Joseph J. Murray, Roger Wallace, and William A. Wenzel (Univ. of California, Berkeley). Phys. Rev. 102, 1622-6(1956) June 15.

An analysis is presented of the pulse distribution produced by antiprotons of 1.2 Bev/c momentum entering a lead-glass Cherenkov counter. The calibration of the counter is described. Estimates of the efficiency of containment of the relativistic secondary particles and electronic showers from annihilation events are discussed and shown to be compatible with the observed pulse-height spectrum. Attenuation effects in a copper absorber preceding the counter, and in the first of two sections of the glass counter, demonstrate interaction and absorption cross sections that are nearly twice geometric and which probably increase as the antiproton kinetic energy decreases below 400 Mev. (auth)

7047

TOTAL ELECTRON COMPTON CROSS SECTION AT 319 MEV. John D. Anderson, Robert W. Kenney, and Charles A. McDonald, Jr. (Univ. of California, Berkeley). Phys. Rev. 102, 1626-31(1956) June 15.

The total cross section for Compton scattering of 319-Mev photons by electrons was measured in an indirect manner to be 2.8 ± 0.4 mb per electron. This result is 8% smaller than the theoretical cross section given by the Klein-Nishina formula, but agrees within the experimental error. The data also yield the triplet-production cross section for beryllium, which was found to be 36.0 ± 3.5 mb per beryllium atom. The theoretical value is 30.2 mb per beryllium atom. The total-absorption cross sections for 319-Mev photons in beryllium and lead were found to be 161.3 ± 1.0 mb per beryllium atom and $(37.620 \pm 0.225) \times 10^{-24}$ cm^2 per lead atom. The ratio of the pair-forming cross sections in beryllium to those in lead, for 319-Mev photons, was found to be $(3.986 \pm 0.020) \times 10^{-3}$. The deviation from experiment of the Bethe-Heitler theory for pair production can be expressed by $\phi_p^z = \phi_p^z(\text{B.H.})[1-aZ^2]$, and a value $a = (1.50 \pm 0.08) \times 10^{-5}$ is derived from the measured absorption cross section for lead. Tables of the principal photon interaction cross sections in beryllium at 319 Mev are included. (auth)

7048

PHASE-SHIFT ANALYSIS OF PROTON-PROTON SCATTERING AT 150 MEV. Shoroku Ohnuma and David Feldman (Univ. of Rochester, N. Y.). Phys. Rev. 102, 1641-7(1956) June 15.

A phase-shift analysis of the 150-Mev proton-proton scattering and polarization data has been carried out assuming that only waves of $J \leq 2$ contribute and neglecting $^3P_2-^3F_2$ coupling. The formulas used to estimate the Coulomb-nuclear interference are essentially non-relativistic, although they include a kinematic correction. Representative sets of phase shifts which fit the data reasonably are tabulated. (auth)

7049

EXPERIMENTS WITH 315-MEV POLARIZED PROTONS. I. ELASTIC SCATTERING BY COMPLEX NUCLEI. Owen Chamberlain, Emilio Segre, Robert D. Tripp, Clyde Wiegand, and Thomas Ypsilantis (Univ. of California, Berkeley). Phys. Rev. 102, 1659-75(1956) June 15.

Experiments on high-energy polarized proton production and scattering from complex nuclei are described. The essentials of the theory of polarization of particles of spin ½ are given in a form suitable for the interpretation of the experimental results. Included is a detailed description of the experimental techniques, the characteristics of the polarized beam, and a discussion of the errors of measurement. The beam was 76% polarized and the maximum beam current was approximately 10^5 protons per second. Results of the scattering experiments on Al, Be, C, Ca, Fe, and Ta are described. Some results of triple-scattering experiments, which further determine the scattering matrix, are also given. The relation of the experimental results to the various theories proposed for explaining the polarization by scattering is discussed. Only qualitative agreement with the theoretical studies made on current models is achieved. Although many of the features predicted by the usual types of potentials are present, no single potential can account for all the observed facts. (auth)

Refer also to abstracts 6815, 6817, 6903, 6930, 6941, 6955, 6957, 6967 and 6968.

RADIATION EFFECTS

7050 AD-77763

Admiral Corp., Chicago.

THE EFFECTS OF NUCLEAR RADIATION ON ELECTRONIC COMPONENTS. Scientific Report No. 1. E. R. Pfaff and R. D. Shelton. Oct. 10. 1955. 62p. Contract AF33(616)-3091.

A selection of electronic components has been irradiated in the CP-5 research reactor at Argonne National Laboratory. The components were subjected to in-pile operation and testing, and the results of this preliminary testing program have been used to provide guidance and background for the formulation of a more extensive and exacting program, the purpose of which is to determine the effects of nuclear radiation on electronic components. The principal effort has been directed toward planning and exploratory tests which would define the problems of component testing, handling and storing of radioactive components, facility planning, radiation monitoring, and data processing. The components tested included wires, capacitors, resistors, and vacuum tubes. These exploratory irradiations and in-pile operating and testing served more as a test of measuring techniques and operating procedures than as a determination of damage thresholds. In general, the operation of a component was influenced by the flux as well as the time integral of the flux. The wires connecting the components to the measuring instruments were subject to radiation effects and there was some difficulty in arriving at a convenient and economical

arrangement for compensating for the contribution of the wires to the experimental readings. The capacitance of twisted wire pairs connecting the components to the test equipment was of the order of 10^{-9} fds and appeared to change very little before an integrated thermal flux of 10^{18} nvt was reached. A typical leakage resistance between wire pairs was 3×10^9 ohms, which dropped by a factor of as much as forty when the reactor was brought to power. The flux dependent of rate effect varied with the length of irradiation. Ceramic, mica, and paper capacitors with a 10^{-9} fd capacity showed small rate effects and more or less permanent damage, the latter tending to diminish somewhat after irradiation. Carbon and wire-wound resistors of approximately 6000 ohms were affected respectively less than 8% and 1% by an irradiation to an integrated thermal flux of 10^{18} nvt. Vacuum tube testing was made difficult by the presence of the radiation field. Large leakages between plate voltage supply lines and high impedance grid circuits resulted in anomalous readings before the trouble was found and corrected. Post irradiation tests indicated that, although most tubes will operate in some manner to an integrated thermal flux of 10^{18} nvt, they seem more susceptible to damage by handling. Several tubes operated to 10^{18} nvt, but were found to have open filaments when the post irradiation tests began. (auth)

7051 NAA-SR-1592

Atomics International Div., North American Aviation, Inc., Canoga Park, Calif.

ORGANIC IN-PILE LOOP NAA-18. S. Nakazato and R. H. J. Gercke. July 1, 1956. 37p. Contract AT-11-1-GEN-8. $0.30(OTS).

An organic in-pile loop experiment was conducted to test the behavior of a diphenyl and ortho- terphenyl eutectic mixture. The test was conducted in the A-14 reflector position of the MTR. Promising results encourage the use of selected organic fluids as possible moderators and coolants in a nuclear reactor. (F.S.)

7052 WADC-TR-55-58

Goodrich (B. F.) Co. Research Center, Brecksville, Ohio.

A STUDY OF THE EFFECTS OF NUCLEAR RADIATIONS ON ELASTOMERIC COMPOUNDS AND COMPOUNDING MATERIALS. D. L. Loughborough, A. E. Juve, J. R. Beatty, and J. W. Born. Dec. 1954. 104p. Project title: ANPP DEVELOPMENT SUPPORT PROJECT. Task title: RUBBER FOR ANPP. Contract AF33(616)-2308. (AD-75867).

Comprehensive study of the effects of nuclear radiation upon elastomeric compounds and compounding ingredients is reported. Two hundred nineteen compounds were selected for study. One hundred ninety were irradiated and tested. Stress-strain and stress relaxation measurements were made, along with special analyses of irradiation products. The investigations exhibit three principal results, a catalog of stress-strain data for many elastomeric formulations has been compiled, a group of inhibitors of radiation deterioration in rubber has been discovered, and evidence has been gathered that the effect of Co^{60} γ irradiation on rubber is different in air from that in high vacuum. The rubber compounds which are most resistant to deterioration are cited by recipe. (auth)

7053

ACTIONS CHIMIQUES ET BIOLOGIQUES DES RADIATIONS (Chemical and Biological Effects of Radiations). M. Haissinsky, ed. Paris, Masson and Co., 1955. 252p.

A discussion is given on the physical aspects of radiobiology including topics such as modes of interaction between radiation and matter, measurement and determination of doses, localization of energy loss along the particle trajectory, and individual energy transfers between the ionizing particle and the absorbing medium. Radiochemistry is also fully discussed including topics such as the development of the chemistry of radiations of aqueous solutions, the effect of ionizing radiations on H_2O, the decomposition of oxygenated H_2O solutions, the radiochemical transformations of iron salt solutions, oxidation of mineral compounds, reductions induced by ionizing radiations, and the oxidation of organic compounds. Modern trends in radiation biochemistry are also discussed. (B.J.H.)

7054

SOME RESISTIVITY EFFECTS OF SHORT-RANGE ORDER IN BRASS. A. C. Damask (Frankford Arsenal, Philadelphia). J. Appl. Phys. 27, 610-16(1956) June.

The annealing kinetics of resistance changes produced in 30% Zn α brass by quench, neutron irradiation at 50°C, and cold work have been studied. It is shown that the relaxation times for these changes agree with those obtained from measurements of stress-induced changes in local order. These resistance changes are therefore interpreted in terms of changes in short-range order. Measurements of resistance as a function of temperature show that an increase of short-range order decreases ρ_0, the residual resistance, and increases ρ_T, the thermal part of resistance. (auth)

7055

EFFECT OF γ RADIATION ON SOLID STATE POLYMERS. II. DETERIORATION OF METHYL POLYMETHACRYLATE AND CELLULOSE ACETATE. Adolphe Chapiro. J. chim. phys. 53, 295-305(1956) Mar. (In French).

The effect of γ rays on methyl polymethacrylate and cellulose acetate was studies. A progressive decrease of fusion temperature with dose was found. The study of the coloring and absorption spectra of the methyl polymethacrylate show the existence of a definite displacement of the absorption region in the ultraviolet towards the visible and the appearance of an absorption band at 5,050 A. This last disappears slowly at 20° and very rapidly at 80°. The significance of these results is discussed and the different chemical processes which might explain the radiochemical deterioration of the polymers are examined. (tr-auth)

7056

ON THE MECHANISM OF RADIOCHEMICAL DETERIORATION OF POLYMERS. Adolphe Chapiro. J. chim. phys. 53, 306-7(1956) Mar. (In French).

7057

BOMBARDMENT OF GLASS BY ALPHA-PARTICLES. D. G. Tuck (United Kingdom Atomic Energy Authority, Windscale Works, Sellafield, England). Nature 177, 434-5 (1956) Mar. 3.

The α irradiation of soda and Pyrex glasses produced more soluble silica in soda glass. Non-uniform α bombardment of the glass surface is suggested. (C.W.H.)

7058

HOLE TRAPPING IN GERMANIUM BOMBARDED BY HIGH-ENERGY ELECTRONS. R. G. Shulman (Bell Telephone Labs., Murray Hill, N. J.) Phys. Rev. 102, 1451-5(1956) June 15.

On the basis of an investigation of n-type germanium bombarded with high-energy electrons, it is concluded that a particular set of temporary hole traps is created by the bombardment. The bombardment centers which remained in the samples at room temperature were measured by resistivity changes and found to agree with the densities of traps. Different samples with trap densities varying from 5×10^{12}/cc to 5×10^{14}/cc were studied. An analysis of the trapping kinetics, essentially similar to those previously reported by Haynes and Hornbeck and by Fan, permits the

energy of the traps to be determined as 0.28 ev above the valence band while the cross section for capture is 6×10^{-15} cm^2 at 200°K. (auth)

7059

PARAMAGNETIC RESONANCE ABSORPTION IN GRAPHITE. G. R. Hennig and B. Smaller (Argonne National Lab., Lemont, Ill.). pp.113-15 in Proceedings of the Conferences on Carbon, University of Buffalo, New York, 1956.

Graphite usually gives rise to an electron spin resonance, which is relatively weak and furthermore sensitive to thermal treatment of the graphite. The spin center concentration decreases as the measuring temperature is lowered. The concentration measured at room temperature is decreased by heating near 1200°C and restored by heating at 1500°C. The thermal stability of the centers is furthermore a function of the crystal size and perfection and is decreased by oxygen. The centers have tentatively been identified with irregularities in the mosaic and peripheral boundaries. (auth)

Refer also to abstracts 6835 and 6865.

RADIOACTIVITY

7060 WADC-TN-55-302

Wright Air Development Center. Materials Lab., Wright-Patterson AFB, Ohio.

ACCESSORY EQUIPMENT AND PROCEDURES FOR USE OF A 1500 CURIE COBALT-60 GAMMA-RAY SOURCE. [Period covered] February 1954 through June 1955. Marvin C. Atkins. Apr. 1956. 17p. Project title: MATERIALS ANALYSIS AND EVALUATION TECHNIQUES. Task title: EFFECTS OF NUCLEAR RADIATIONS ON MATERIALS AND PROCESSES.

A 1500-c Co^{60} source is being used to investigate the effects of gamma radiation on materials. The source is a cylinder, 1.78 in. I.D. × 2.31 in. O.D. × 13.5 in. long. It is shielded by a lead container which is mounted on a table behind a concrete block wall. A rotating-beam hoist is used to change samples. Other items of accessory equipment include specialized plugs for the container, additional sample canisters, and a cooling system. Measurements have been made of scattered radiation from the source, and a standard operating procedure for use of the source has been established. This procedure has significantly reduced the probability of personnel exposure to harmful radiation. (auth)

7061 AERE-Lib/Trans-652

AVERAGE NUMBER OF NEUTRONS PER FISSION IN THE PHOTODISINTEGRATION OF URANIUM AND THORIUM. B. N. Valuyev, B. I. Gavrilov, G. N. Zatsepina, and L. E. Lazareva. Translated by R. D. Lowde from Zhur. Eksptl'. i Teoret. Fiz. 29, 280-5(1955). 9p.

The average number ν of neutrons per fission in the photodisintegration of U and Th has been determined for a mean nuclear excitation energy of about 12 Mev. Values of ν obtained were 6.2 ± 0.5 for U; and 14.2 ± 1.2 for Th. The measurements permitted an estimate of the relative fission probabilities for U and Th nuclei undergoing photodisintegration. (auth)

7062

RaD, RaE, AND Po IN THE ATMOSPHERE. P. King, L. B. Lockhart, Jr., R. A. Baus, R. L. Patterson, Jr., H. Friedman, and I. H. Blifford, Jr. (Naval Research Lab., Washington, D. C.). Nucleonics 14, No. 6, 78, 80-2, & 84(1956) June.

Facilities were installed in different parts of the world to collect natural radioactive products from the atmosphere. The quantities of Pb^{210}, Bi^{210}, and Po^{210} in the atmosphere were determined. (F.S.)

7063

LOG-LOG SCALE BECOMES DECAY TABLE. R. Hobart Ellis, Jr. Nucleonics 14, No. 6, 86(1956) June.

A method is given for the computation of radioactive decays using the LLO scale of a log slide rule. (F.S.)

7064

NEUTRON FLUXES UNDERGROUND. K. B. Mather (Univ. of Melbourne, Australia). Australian J. Phys. 9, 147-50 (1956) Mar.

A negative result was reported in an experiment to test a report that radiation came from the center of the earth. Factors which may have led to erroneous values in the previous report are discussed. (F.S.)

7065

COMPOSITION OF THE $^7Li(p,\gamma)$ RADIATION BELOW THE 441 KEV RESONANCE. J. G. Campbell (Univ. of Melbourne, Australia). Australian J. Phys. 9, 156-8(1956) Mar.

The energy of the γ radiation emitted from the bombardment, by protons with less than 400 kev energy, of thick and thin Li targets was found. (F.S.)

7066

THE DECAY OF POTASSIUM 40. A. McNair, R. N. Glover, and H. W. Wilson (Univ. of Glasgow, Scotland). Phil. Mag. (8) 1, 199-211(1956) Feb.

The decay of K^{40} has been reinvestigated and values of the branching ratio, defined as the ratio of gamma or electron capture to beta transitions, have been determined by two methods, giving the values 0.124 ± 0.002 and 0.121 ± 0.004 respectively. The absolute beta and gamma decay rates and the half life have been measured, the value of the latter being $1.28 \pm 0.02 \times 10^9$ years. A fresh determination of the gamma energy is described, and evidence as to the mode of decay is discussed. Finally, the results are given of experiments on the reflection of electrons by solid source supports. (auth)

7067

THE DECAY OF ^{58}Co AND ^{57}Co. M. A. Grace, G. A. Jones, and J. O. Newton (Atomic Energy Research Establishment, Harwell, Berks, England). Phil. Mag. (8) 1, 363-9(1956) Apr.

The single channel Co^{58} γ-ray spectrum and the spectrum in coincidence with K-x-rays have been studied with scintillation counters and a proportional counter and show no evidence for radiation other than the well-established 805-kev γ-ray. Our results accord well with the decay scheme of Deutsch and Elliott. An upper limit of 2.5×10^{-3} per disintegration was set on the intensity of 29-kev γ radiation which, according to a recent suggestion, follows the decay of Co^{57}. (auth)

7068

LOW-LYING STATES OF F^{19}: REACTION $F^{19}(p,p')F^{19}$. B. J. Toppel, D. H. Wilkinson, and D. E. Alburger (Brookhaven National Lab., Upton, N. Y.). Phys. Rev. 101, 1485-92(1956) Mar. 1.

The gamma radiation following inelastic proton scattering from F^{19} has been observed using 2.4- to 4.1-Mev protons from the BNL research Van de Graaff. Gamma rays of energies 1.238 ± 0.010 and 1.350 ± 0.010 Mev are observed in the singles NaI(Tl) spectrum using 3.0-Mev protons. The angular distributions these γ rays show anisotropies of +29% and −29% respectively. Three-crystal pair-spectrometer measurements at 3.0 and 3.5 Mev indicate that a 1.449 ± 0.010-Mev γ ray is also present. Coincidence measurements at 3.0 Mev show that γ rays of energies 1.233 ± 0.010 and 1.346 ± 0.010 Mev are in prompt coincidence with 109-kev radiation while a 1.354 ± 0.010-Mev γ ray is in delayed coincidence with 197-kev radiation. These observations imply states in F^{19} at 1.342 ± 0.010, 1.452 ± 0.010, and 1.551 ± 0.010 Mev. The observed relative γ-ray intensities show that the

1.24-Mev radiation originates mainly from the 1.34-Mev state and that the 1.34-Mev state exhibits less than an 8% branch to the J = 5/2+ level at 197 kev. These observations together with the fact that the 1.24-Mev radiation is non-isotropic indicate an assignment J = 3/2 for the 1.34-Mev state. (auth)

7069

GAMMA-RAY ANGULAR DISTRIBUTION IN COULOMB EXCITATION. G. Breit, M. E. Ebel, and J. E. Russell (Yale Univ., New Haven, Conn.). Phys. Rev. 101, 1504-7 (1956) Mar. 1.

In view of discrepancies in the literature regarding signs in formulas for the angular distribution of gamma rays emitted in Coulomb excitation, this distribution is worked out for the special case of 0→2 transitions. The calculation is quantum mechanical and neglects higher than first-order effects in the Coulomb energy. The signs and forms obtained are confirmed by a semiclassical calculation. (auth)

7070

DECAY OF Mg^{27}. W. S. Lyon and N. H. Lazar (Oak Ridge National Lab., Tenn.). Phys. Rev. 101, 1524-6(1956) Mar. 1.

The γ rays accompanying the decay of 9.45-min Mg^{27} have been studied by use of a NaI scintillation spectrometer and β-γ coincidence counting. Three γ rays of energies 0.834, 1.015, and 0.175 Mev were found with relative intensities of 1.00, 0.43, and 0.009. The isotopic thermal-neutron activation cross section for production of Mg^{27} is found to be 25 ± 2 millibarns. (auth)

7071

INTERNAL CONVERSION SPECTRUM OF Au^{198}. Donald R. Connors, Walter C. Miller, and Bernard Waldman (Univ. of Notre Dame, Ind.). Phys. Rev. 102, 1584-6(1956) June 15.

An absolute energy determination for the internal conversion electrons from Au^{198} has been made with an electrostatic analyzer. The gamma-ray energy has been determined from these results to be 411.76 ± 0.19 kev. The intensity ratios $(L_I : L_{II} : L_{III})$ in the L subshell are found to be (1.9 ± 0.3) : (2.2 ± 0.3) : 1.0, in agreement with theory for an E2 transition. A determination of the internal conversion coefficients gave $\alpha_K = 0.025 \pm 0.005$ and $\alpha_L = 0.012 \pm 0.002$. (auth)

7072

RADIATIONS OF Te^{127} AND Te^{127m}. J. D. Knight, J. P. Mize, J. W. Starner, and J. W. Barnes (Los Alamos Scientific Lab., N. Mex.). Phys. Rev. 102, 1592-7(1956) June 15.

The radiations of Te^{127} and Te^{127m} have been examined by beta-ray spectrometry and gamma-ray scintillation spectrometry. Te^{127} (9.35 ± 0.10 hr) decays predominantly (99%) by a beta transition of end-point energy 695 ± 10 kev to the ground state of I^{127}. The remaining 1.0 ± 0.2% of the decay is accompanied by gamma rays of energies 58.5 ± 1, 145 ± 2, 203 ± 3, 215 ± 4, 360 ± 4, and 418 ± 2 kev. By means of gamma-gamma coincidence measurements, these gamma rays have been fitted into a consistent decay scheme which involves levels in I^{127} at 58.5, 203, and 418 kev. Te^{127m} (105 ± 2 days), which decays predominantly by the well-known 89-kev isomeric transition, also has a 1.5 ± 0.5% beta branch which populates the 58.5-kev level in I^{127} and another beta branch of total intensity ~0.013% which is accompanied by a gamma ray of energy 665 ± 5 kev. Plausible spin and parity assignments for the excited levels of I^{127} are discussed. (auth)

7073

VERY LONG-LIVED NATURAL α-EMITTER. W. Porschen and W. Riezler. Z. Naturforsch. 11a, 143-51(1956) Feb. (In German)

7074

DECAY OF Al^{25}. Th. Stribel. Z. Naturforsch. 11a, 166-7 (1956) Feb. (In German)

7075

MEASUREMENT OF THE K SHELL CONVERSION COEFFICIENTS OF THE 95 KEV TRANSITION OF Ho^{165}. Th. Stribel (Max Planck Inst. for the Physics of the Stratosphere, Hechingen, Germany). Z. Naturforsch. 10a, 894 (1955) Nov. (In German)

7076

THE NUMBER OF GAMMA QUANTA OF POTASSIUM. G. Backenstoss and K. Goebel. Z. Naturforsch. 10a, 920-4 (1955) Dec. (In German)

7077

A NEW METHOD OF ROENTGEN-STRUCTURAL INVESTIGATION OF RADIOACTIVE MATERIALS. S. T. Konobeevskiĭ, B. M. Levitskiĭ, and Yu. A. Martynyuk. Zhur. Tekh. Fiz. 26, 870-3(1956) Apr. (In Russian)

A monochromatic x-ray-diffraction method is offered for structural investigation of radioactive materials. Short descriptions of the x-ray spectrometer and its radiodiagrams are given. (R.V.J.)

7078

INVESTIGATIONS ON THE β-DECAY OF $^{208}_{81}Tl$(ThC″). F. Demichelis, R. A. Ricci, and G. Trivero (Istituto di Fisica Sperimentale del Politecnico, Torin). Nuovo cimento (10) 3, 377-89(1956) Feb. (In English).

The β spectrum of Tl^{208} has been investigated by the following experimental methods: the absorption method, the β-γ coincidence technique, and the grey wedge oscillographic method. The experimental results show the existence of a new β transition with maximum energy 2.37 Mev from the ground state of Tl^{208} to the first excited state of Pb^{208}. Its relative intensity (branching ratio) is ≈ 1.5% of the disintegrations of Tl^{208}. The 2.37-Mev β transition is followed by a 2.62-Mev γ ray. The already known β transition of maximum energy 1.79 Mev was found and β transitions of maximum energy 1.28 Mev; and 1.52 Mev were detected. The existence of a β branch of maximum energy (2.15 ± 0.11) Mev was noted; it must be assigned to Bi^{212} (value already known: 2.25 Mev) which is present with Tl^{208} in the radioactive source ($Rd^{228}Th$ in equilibrium with its decay products). In conclusion, the degree of forbiddenness of the higher energy components (2.37 Mev; 2.25 Mev; 1.79 Mev) is discussed. (auth)

Refer also to abstracts 6574 and 7107.

RARE EARTHS AND RARE-EARTH COMPOUNDS

7079

ABSORPTION, FLUORESCENCE, AND ENERGY LEVELS OF THE DYSPROSIUM ION. G. H. Dieke and Shobha Singh (Johns Hopkins Univ., Baltimore). J. Opt. Soc. Amer. 46, 495-9(1956) July.

The absorption and fluorescence spectra of $DyCl_3 \cdot 6H_2O$ have been observed at 4.2 and 77°K. This makes an analysis of the low-lying levels possible including their Stark splitting. The strong lines have been interpreted as transitions between the H^6, P^6, and F^6 multiplets. The Zeeman effect gives a splitting of $g_1 = 6.73$ if the acute bisectrix is parallel to the field. (auth)

SHIELDING

7080 NARF-55-96T

Convair, Fort Worth, Tex.

DESCRIPTION OF THE ASTR SHIELD. M. A. Dewar.

May 15, 1956. 24p. Project 6(1-9964). Contract AF33 (600)-32054. (MR-N-112).

A detailed description of the entire ASTR Shield is presented. This description covers dimensions, materials, and, where appropriate, material weights and tank capacities. (auth)

7081 WAPD-P-646

[Westinghouse Electric Co. Atomic Power Div., Pittsburgh].

THE THEORETICAL BUILD-UP FACTOR FOR ORDINARY CONCRETE. F. E. Obenshain. Mar. 1955. 6p. $1.80 (ph OTS); $1.80(mf OTS).

The build-up factor for ordinary concrete (2.3 gm/cm^3) was theoretically determined for gamma rays having the initial energy between 0.5 and 10 Mev. The result was found to be in excellent agreement with experiment at 6.1 Mev. (auth)

7082

SCATTERING OF HIGH-ENERGY GAMMA RAYS. David H. Green and E. C. Gregg (Case Inst. of Tech., Cleveland, Ohio). J. Appl. Phys. 27, 697-8(1956) July.

The scattering of 16-Mev bremsstrahlung by 3, 6, and 9 in. of iron was measured for small angles using a thallium-activated sodium-iodide scintillation counter. The experimental results closely fitted a theoretical curve calculated on the basis of single scattering. (auth)

7083

REFLECTION AND TRANSMISSION OF GAMMA RADIATION BY BARRIERS: SEMIANALYTIC MONTE CARLO CALCULATION. Martin J. Berger and John Doggett. J. Research Natl. Bur. Standards 56, 89-98(1956) Feb.

The transport equation for photons which have been Compton-scattered repeatedly with a specified sequence of energy losses and deflections was solved analytically, by an "orders of scattering" approach, to obtain conditional reflection and transmission probabilities. These probabilities were then averaged over all possible intermediate angular and energy configurations in a Monte Carlo calculation carried out on the NBS automatic computer (SEAC). The efficiency of the Monte Carlo calculation was increased by taking advantage of the close correlation between the transmission of radiation through thick barriers and the corresponding penetration problem in an infinite homogeneous medium for which an exact solution was available. The reflected and transmitted energy flux (integrated over all spectral energies and directions) has been calculated for 0.66-, 1- and 4-Mev radiation incident on water barriers, and 1-, 4-, and 10-Mev radiation incident on iron, tin, and lead barriers. Angular and energy spectra were obtained for water at 0.66 Mev. The ratio of the scattered energy flux, transmitted through a barrier to the scattered flux at equal depth in an infinite medium, was found to be constant for distances from the source greater than four mean free paths of the source radiation. (auth)

SPECTROSCOPY

7084 NP-5999

Massachusetts Inst. of Tech., Cambridge. Lab. for Insulation Research.

THE INFRARED SPECTRA OF HDO IN WATER AND IONIC SOLUTIONS. Technical Report 108. R. D. Waldron. May 1956. 19p. Contract N5ori-07801.

The infrared spectra of HDO in water and saturated metal halide solutions were investigated to study the interactions between ions and solvent molecules and the nature of hydrogen bonding in aqueous systems. The fundamental and overtone bands of the OH and OD stretching vibrations are shifted to lower frequencies and the bending vibration shifts to higher frequencies as one passes from the gaseous to the liquid state. Similar shifts occur for the metal halide solutions, the magnitudes of which are sensitive to the anion species but relatively independent of the cations. The frequency shifts for ionic solutions increase in the order I^-, Cl^-, F^-, with the shift in ion-free water about equal to that for Cl^-. The data are analyzed in terms of 4 probable nearest-neighbor configurations in these solutions. The vibrational anharmonicity of the OH stretching vibration in solution is nearly independent of the frequency shift and only slightly larger than the gas value. The dependence of frequency shift on the shortening of hydrogen bonds (volume contraction) and H-bond energy was studied and gave qualitative agreement with other systems previously investigated. (auth)

7085 AERE-Lib/Trans-634

INVESTIGATION OF THE HYPERFINE STRUCTURE OF THE SPECTRA OF PLUTONIUM AND OF URANIUM ISOTOPES. N. I. Kaliteevskii and M. P. Chaika. Translated by J. B. Sykes from Doklady Akad. Nauk S.S.S.R. 103, 49-51(1955). 4p.

This report was title-listed as NSA 9-6627.

7086

THE INFRARED SPECTRUM OF ACETYLENE-d_1. Harry C. Allen, Jr., Eugene D. Tidwell, and Earle K. Plyler (National Bureau of Standards, Washington, D. C.). J. Am. Chem. Soc. 78, 3034-40(1956) July 5.

The vibrational-rotational spectrum of acetylene-d_1 has been observed and measured from 1800 to 9200 cm^{-1}. Rotational structure sufficient to enable an analysis was found for 28 bands. From the average combination-difference values of the 14 best bands the rotational constants were found to be, $B_0 = 0.99169 \pm 0.00015$ cm^{-1} and $D_0 = 1.08 \pm 0.26 \times 10^{-6}$ cm^{-1}. The vibrational energy system is fully discussed. It is pointed out that the vibrational energy levels cannot be fit by the usual quadratic expansion of the energy in terms of the vibrational quantum numbers. Evidence is presented to show that at least cubic terms must be included in the expansion. (auth)

7087

SPECTRAL EMISSIVITY OF RHENIUM. D. T. F. Marple (General Electric Research Lab., Schenectady, N. Y.). J. Opt. Soc. Amer. 46, 490-4(1956) July.

The spectral emissivity of Re has been measured at temperatures between 1537 and 2772°C for wavelengths between 0.35 and 2.8μ. The emissivity at 0.65μ agrees well with previous measurements for temperatures below 2200°C, and disagrees only slightly above this temperature. The method and equipment used in the measurements are discussed, and the errors are analyzed. The measured emissivities, and the temperature coefficient of emissivity are compared with the predictions of the Hagen-Rubens relation. (auth)

7088

NEW DESCRIPTIONS AND ANALYSES OF THE THIRD AND FOURTH SPECTRA OF ZIRCONIUM, Zr(III) AND Zr(IV). C. C. Kiess. J. Research Natl. Bur. Standards 56, 167-77 (1956) Apr.

Recent observations of the spectra emitted by ionized zirconium atoms have added many new lines to the descriptions of these spectra and have led to revisions and extensions of their term structures. The low, even terms of Zr III arise in the electron configurations $4d^2$, 4d 5s, and $5s^2$. Excitation of these states leads to higher terms of the 4d 5p, 5s 5p, 4d 5d, 4d 6s, 4d 4f, 5s 5d, 4d 6p, 5s 6s, 5s 4f, and 5s 5g configurations. Most of the singlet and triplet terms from these configurations have now been established. Zeeman patterns from MIT plates have confirmed and cor-

rected some of the classifications of earlier work. From the series-forming terms of Zr III the separation of the ground states of Zr III and Zr IV is calculated as 198590 cm^{-1}, corresponding to an ionization potential of 24.6 electron volts for the ion Zr^{2+}. In the doublet spectrum of Zr IV, which arises from the migration of the single electron outside the krypton shell, the terms from the 7s, 6p, 6d, 5f, 6f, 5g, and 6g electrons have been added to those already known. A mean value of 276970 cm^{-1} for the separation of the ground states of Zr IV and Zr V has been derived from three accordant values calculated from series of ^2S, $^2F°$, and ^2G terms. This corresponds to an ionization potential of 34.33 electron volts for Zr^{3+}. (auth)

7089

LOCATING COMPTON EDGES AND BACKSCATTER PEAKS IN SCINTILLATION SPECTRA. B. Crasemann and H. Easterday (Univ. of Oregon, Eugene). Nucleonics 14, No. 6, 63(1956) June.

The behavior of the Compton distribution and backscatter peak appearing with photopeaks in a scintillation spectrum was investigated. Larger scintillation crystals reduce the Compton edge and a crystal container of low atomic-number diminishes the backscatter peak. (F.S.)

7090

COINCIDENCE MEASUREMENTS ON THE β-DECAY OF BORON 12. N. W. Tanner (Cavendish Lab., Cambridge, England). Phil. Mag. (8) 1, 47-54(1956) Jan.

A study of β-γ and γ-γ coincidences associated with the β-decay of B^{12} has been made in order to analyze the β-spectrum. It is concluded that, relative to the transition to the ground state of C^{12}, $(1.7 \pm 0.4)\%$ of the β transitions are to the 4.43 Mev excited state, and $\leq(0.0 \pm 0.2)\%$ to the 7.66 Mev state. A technique of comparison between B^{12} and Li^8 was used which gave a new upper limit of $\leq(0.2 \pm 0.1)\%$ for γ radiation following the Li^8 decay. (auth)

7091

CONTRAST CHANGES OF EASTMAN KODAK SPECTRUM ANALYSIS NO. 1 EMULSION DURING COLD STORAGE, AND THEIR EFFECT ON OBSERVED INTENSITY RATIOS. Cyrus Feldman and Janus Y. Ellenburg (Oak Ridge National Lab., Tenn.). Spectrochim. Acta 7, 349-57(1956).

This emulsion showed 0 to 4% decreases in contrast at various wavelengths when stored one year at −17.8°C, and 4 to 12% increases in contrast when stored for the same period at 4.4°C. (auth)

7092

MEASUREMENT OF A 30 MEV BETATRON BREMSSTRAHLUNG SPECTRUM WITH THE COMPTON SPECTROMETER. K. Ulmer and B. Ziegler. Z. angew. Phys. 8, 49-53(1956) Feb. (In German)

7093

A STIGMATIC IMAGE-FORMING DOUBLE-FOCUSING MASS SPECTROGRAPH. H. Ewald and G. Sauermann. Z. Naturforsch. 11a, 173-4(1956) Feb. (In German)

7094

SHUTTER AND MOTOR DRIVE FOR A LITTROW-ECHELLE SPECTROGRAPH. Louis E. Owen (Goodyear Atomic Corp., Portsmouth, Ohio). Appl. Spectroscopy 10, No. 1, 4-7 (1956) Feb.

An internally mounted shutter and a motor drive attachment for the plate-racking mechanism of a Littrow-Echelle spectrograph are described. An associated electrical circuit provides automatic exposure control and predetermined automatic racking. Ease and exactness of operation are the primary benefits obtained. (auth)

Refer also to abstract 6949.

THEORETICAL PHYSICS

7095 AERE-T/M-135

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

THE GROWTH IN TIME OF A HYDROMAGNETIC SHOCK. W. Marshall. May 1956. 9p.

In a previous report the structure of steady hydromagnetic shocks was discussed theoretically and it was shown that the situation most likely to be met with experimentally was that in which an ordinary hydrodynamic shock was preceded by a region of width $\approx (c^2/4\pi\sigma u_1)$ cms, where σ is electrical conductivity and u_1 the velocity of the shock, in which the magnetic field changed slowly. In this report the time development of such a shock is considered and an estimate of the time required to set up the steady state is given. It is shown that the magnetic field increases rapidly in front of the shock until the steady state is set up; when this is done the shock has travelled about $16 \times c^2/4\pi\sigma u_1$ cms. The time required to set up a steady state behind the shock is longer. The field is shown as a function of the distance from the hydrodynamic shock for various times. (auth)

7096

A COLLECTIVE MODEL FOR THE NUCLEAR PHOTO-REACTIONS. V. de Sabbata and A. Sugie (Univ. of Birmingham, England). Nuovo cimento (10) 3, 16-32(1956) Jan. (In English)

For the nuclear photo-reaction in the giant resonance region, a collective model was considered which includes both the Goldhaber-Teller and Steinwedel-Jensen type of motion. A coupling of these two modes through the kinetic energy was found. This leads to two resonance frequencies. If the higher resonance is identified as the giant resonance, a better dependence on mass number A of the resonance frequency is found. But the absolute value of the integrated cross-section is far too small. On the other hand if the lower energy level is identified as the giant resonance, there is a better A-dependence of the resonance frequency, and the absolute value of the integrated cross-section is of the right order of magnitude. But in this case, an increase of about twice the force constants in the two models must be made. (auth)

7097

A QUANTUM THEORY OF REFRACTIVE INDEX, ČERENKOV RADIATION AND IONIZATION LOSS. D. A. Tidman (Univ. of Sydney, Australia). Nuovo cimento (10) 3, 503-4(1956) Feb. (In English).

7098

THE STRUCTURE OF THE NUCLEON. S. Fubini (Istituto di Fisica dell'Universita, Torin). Nuovo cimento (10) 3, 1425-32(1956) June.

From the fixed source meson theory, an exact relation connecting the structure of the physical nucleon to the meson nucleon scattering amplitudes was derived. General formulae were obtained for the charge and current densities of the meson cloud of the nucleon. Using these results it is possible to obtain an upper limit of 5.5 meson masses for the cut-off and of 1.65 for the average number of mesons in the cloud. The nucleon magnetic moments take the correct experimental values ±1.9 in correspondence of a cut-off to 5 meson masses. (auth)

7099

STRANGE PARTICLES AND THE CONSERVATION OF ISOTOPIC SPIN. A. Gamba (Istituto di Fisica dell'Universita, Torin). Nuovo cimento (10) 3, 1486-7(1956) June.

7100

CALCULATION OF ELECTRIC DIPOLE COULOMB EX-

CITATION AND DIPOLE BREMSSTRAHLUNG. R. M. Thaler, M. Goldstein, J. L. McHale (Los Alamos Scientific Lab., N. Mex.) and L. C. Biedenharn (Rice Inst., Houston, Tex.). Phys. Rev. 102, 1567-71(1956) June 15.

Numerical results are obtained for electric dipole Coulomb excitation. Tables of the dimensionless excitation function a_0 and the directional correlation parameter a_2 are presented over a very wide range of their arguments. It is shown that the dipole bremsstrahlung cross section can be written in terms of the a_μ, so that the tabulation also serves for the calculation of the bremsstrahlung differential cross section. (auth)

7101

EXACT SUM RULES IN THE FIXED-SOURCE MESON THEORY. M. Cini (Istituto di Fisica dell'Universita di Catania, Italy) and S. Fubini (Istituto di Fisica dell'Universita di Torin, Italy). Phys. Rev. 102, 1687-8(1956) June 15.

Exact relations obtained by making use of recent techniques connecting matrix elements of Heisenberg operators are reported. Their implications about the nature of the solution of the fixed-source meson theory are discussed. (D.E.B.)

7102

THE DENSITY MATRIX IN SELF-CONSISTENT FIELD THEORY. I. ITERATIVE CONSTRUCTION OF THE DENSITY MATRIX. R. McWeeny (King's Coll., Newcastle upon Tyne, England). Proc. Roy. Soc. (London) A235, 496-509 (1956) June 12.

The approximate self-consistent field equations of Roothaan are studied from the standpoint of density matrix theory. Their direct solution, which entails repeated determination of the individual occupied orbitals, is shown to be quite unnecessary. All information about the system under consideration can be obtained in terms of a one-particle density matrix; and this can be constructed by an iterative method which involves only matrix algebra. As an illustration of the method, the ground state of the Be atom is calculated. The solution, which is approximated in a basis of four Slater functions, surpasses in accuracy all other analytical one-determinant wave functions so far available, with one exception. And although it approaches the accurate solution of the Hartree-Fock equations the computation required is relatively small. Extensions of the method, in order to admit configuration-interaction calculations, are also discussed. An appendix introduces a 'steepest descent' method of solving eigenvalence problems, which may be regarded as the prototype of the iterative construction described in the paper. (auth)

7103

CORRELATION FACTORS FOR DIFFUSION IN SOLIDS. K. Compaan and Y. Haven (Phillips Research Labs., Eindhoven, Netherlands). Trans. Faraday Soc. 52, 786-801 (1956) June.

The relation of Einstein D = BkT/e, relating the diffusivity and mobility of particles (ions or atoms) must be altered where D is the diffusion constant of tracers in solids, if a vacancy mechanism holds, because there will be a correlation between successive steps of a particle, even if the steps of the vacancies themselves are uncorrelated. Certain symmetry conditions being fulfilled, the relation of Einstein must be extended with a correlation factor $f = (1 + \overline{\cos\theta}_{i,i+1})/(1-\overline{\cos\theta}_{i,i+1})$, where $\theta_{i,i+1}$ is the angle between two successive steps of a particle. The diffusion problem can be translated into the theory of electrical networks and with the help of measurements in a resistor network the value of $\overline{\cos\theta}_{i,i+1}$ is easily evaluated. This has been done for several types of lattices. Other cases are treated by similar methods. Appropriate substitutions having been made, the diffusion of associated pairs has been treated as the diffusion of a single particle in a so-called transposed lattice. (auth)

7104

THE S-MATRIX FOR NEUTRAL PS-PV MESON-NUCLEON INTERACTION. J. S. R. Chisholm (Univ. Coll., Cardiff). Phil. Mag. (8) 1, 338-44(1956) Apr.

Nucleon and neutral meson fields with an exponential interaction, derived from the ps−pv interaction by the Dyson transformation, are studied. A new system of graphs called 'skeletons' is described; the S-matrix for any process is the sum of terms corresponding to skeletons with the appropriate external lines. (auth)

Refer also to abstract 6816.

TRITIUM AND TRITIUM COMPOUNDS

7105

TRITIUM-GAS DISPENSER. John A. Barton and Daniel Parrish (V. A. Hospital and Univ. of Washington School of Medicine, Seattle). Nucleonics 14, No. 6, 84 & 86(1956) June.

A tritium burette to deliver small and accurately known amounts of activity from a vial containing 50 to 100 millicuries is described. (F.S.)

Refer also to abstract 7009.

URANIUM AND URANIUM COMPOUNDS

7106 AERE-G/M-38

Gt. Brit. Atomic Energy Research Establishment, Harwell, Berks, England.

ELECTRON MICROSCOPE STUDIES OF PARTICLE SIZE IN AMMONIUM DIURANTE. C. S. Lees. 1955. 8p.

7107

ON THE ENERGY SPECTRUM OF γ RAYS EMITTED FROM U^{235} FISSION PRODUCTS. E. Germagnoli and L. Mongini (Laboratori CISE, Milan). Energia nucleare (Milan) 3, 32-8(1956) Feb. 15. (In Italian).

The energy spectrum of γ rays emitted from fission products has been examined by means of a single crystal γ spectrometer over in interval of about 20 months after the irradiation of uranium. As long as isotopes whose half-life is longer than 5 days are considered, a satisfactory agreement has been found between the measured energies and intensities of γ lines and the expected ones. (auth)